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WHAT'S INSIDE

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles *see 12 Astronautics*.

20030062123 NASA Langley Research Center, Hampton, VA, USA

Comparison of Methods for Determining Boundary Layer Edge Conditions for Transition Correlations

Liechty, Derek S.; Berry, Scott A.; Hollis, Brian R.; Horvath, Thomas J.; [2003]; 11 pp.; In English; 33rd AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2003, Orlando, FL, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-3590; No Copyright; Avail: CASI; A03, Hardcopy

Data previously obtained for the X-33 in the NASA Langley Research Center 20-Inch Mach 6 Air Tunnel have been reanalyzed to compare methods for determining boundary layer edge conditions for use in transition correlations. The experimental results were previously obtained utilizing the phosphor thermography technique to monitor the status of the boundary layer downstream of discrete roughness elements via global heat transfer images of the X-33 windward surface. A boundary layer transition correlation was previously developed for this data set using boundary layer edge conditions calculated using an inviscid/integral boundary layer approach. An algorithm was written in the present study to extract boundary layer edge quantities from higher fidelity viscous computational fluid dynamic solutions to develop transition correlations that account for viscous effects on vehicles of arbitrary complexity. The boundary layer transition correlation developed for the X-33 from the viscous solutions are compared to the previous boundary layer transition correlations. It is shown that the boundary layer edge conditions calculated using an inviscid/integral boundary layer approach are significantly different than those extracted from viscous computational fluid dynamic solutions. The present results demonstrate the differences obtained in correlating transition data using different computational methods.

Author

Boundary Layer Transition; Inviscid Flow; Computational Fluid Dynamics; Surface Roughness; Viscous Flow

20030062138 Johns Hopkins Univ., Baltimore, MD, USA

Microsample Characterization of Coatings for GRCop-84 for High Heat Flux Applications

Hemker, Kevin; Raj, Sai, Technical Monitor; April 2003; 10 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG3-2690; WU 708-87-23

Report No.(s): NASA/CR-2003-212200; E-13803; NAS 1.26:212200; No Copyright; Avail: CASI; A02, Hardcopy

A multidisciplinary Johns Hopkins University-NASA Glenn team is undertaking a collaborative research program to elucidate and model the thermal stability and mechanical integrity of candidate coatings for GRCop-84. GRCop-84 is a high conductivity, high strength copper alloy that was recently developed at NASA Glenn for use in high temperature, high heat flux applications. With potential applications in rocket motor combustion chamber liners, nozzle ramps and other actively cooled structures, this new material offers great potential for decreasing weight and increasing reliability of third generation reusable launch vehicles. Current emphasis has turned toward the development of environmentally resistant and thermal barrier coatings for this alloy. Metallic coatings such as NiCrAlY and Cu-8-30\%Cr have shown promise in: prohibiting blanching, reducing dog-house failures, increasing operating temperatures and decreasing cooling requirements. The focus of this research program is to develop a fundamental understanding of the substrate-coating interactions that occur during thermal cycling (inter-diffusion, viscoplasticity, morphological evolution, crack formation, etc.) and to derive a science-based protocol for future coating selection, optimization and reliability assurance. The microsample tensile testing approach adopted for this study allows us to characterize small-scale and highly scale-specific coatings and properties in a way not possible by conventional means. In addition to providing much needed design data, the integration of microsample testing with detailed

microstructural observations provides a mechanistic foundation for coating optimization and life prediction modeling.
Author
Metal Coatings; Heat Flux; Microstructure; Tensile Tests; Copper Alloys; Heat Resistant Alloys; Mechanical Properties; Coating

20030063115 Santa Clara Univ., CA, USA
Evaluating Behaviorally Oriented Aviation Maintenance Resource Management (MRM) Training and Programs: Methods, Results, and Conclusions
Taylor, James C.; Thomas, Robert L., III; June 30, 2003; 72 pp.; In English
Contract(s)/Grant(s): NCC2-1156; SCU Proj. NAR-006; No Copyright; Avail: CASI; A04, Hardcopy

Assessment of the impact of Aviation Resource Management Programs on aviation culture and performance has compelled a considerable body of research (Taylor & Robertson, 1995; Taylor, 1998; Taylor & Patankar, 2001). In recent years new methods have been applied to the problem of maintenance error precipitated by factors such as the need for self-assessment of communication and trust. The present study - 2002 -- is an extension of that past work. This research project was designed as the conclusion of a larger effort to help understand, evaluate and validate the impact of Maintenance Resource Management (MRM) training programs, and other MRM interventions on participant attitudes, opinions, behaviors, and ultimately on enhanced safety performance. It includes research and development of evaluation methodology as well as examination of psychological constructs and correlates of maintainer performance. In particular, during 2002, three issues were addressed. First, the evaluation of two (independent & different) MRM programs for changing behaviors was undertaken. In one case we were able to further apply the approach to measuring written communication developed during 2001 (Taylor, 2002; Taylor & Thomas, 2003). Second, the MRM/TOQ surveys were made available for completion on the internet. The responses from these on-line surveys were automatically linked to a results calculator (like the one developed and described in Taylor, 2002) to aid industry users in analyzing and evaluating their local survey data on the internet. Third, the main trends and themes from our research about MRM programs over the past dozen years were reviewed.
Derived from text
Aeronautics; Project Management; Aircraft Maintenance; Education; Civil Aviation

20030063134 NASA Langley Research Center, Hampton, VA, USA
Computational Aeroelasticity: Success, Progress, Challenge
Schuster, David M.; Liu, Danny D.; Huttsell, Lawrence J.; [2003]; 24 pp.; In English; AIAA Dynamics Specialists Conference, 7-10 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1725; Copyright; Avail: CASI; A03, Hardcopy

The formal term Computational Aeroelasticity (CAE) has only been recently adopted to describe aeroelastic analysis methods coupling high-level computational fluid dynamics codes with structural dynamics techniques. However, the general field of aeroelastic computations has enjoyed a rich history of development and application since the first hand-calculations performed in the mid 1930 s. This paper portrays a much broader definition of Computational Aeroelasticity; one that encompasses all levels of aeroelastic computation from the simplest linear aerodynamic modeling to the highest levels of viscous unsteady aerodynamics, from the most basic linear beam structural models to state-of-the-art Finite Element Model (FEM) structural analysis. This paper is not written as a comprehensive history of CAE, but rather serves to review the development and application of aeroelastic analysis methods. It describes techniques and example applications that are viewed as relatively mature and accepted, the ‘successes’ of CAE. Cases where CAE has been successfully applied to unique or emerging problems, but the resulting techniques have proven to be one-of-a-kind analyses or areas where the techniques have yet to evolve into a routinely applied methodology are covered as ‘progress’ in CAE. Finally the true value of this paper is rooted in the description of problems where CAE falls short in its ability to provide relevant tools for industry, the so-called ‘challenges’ to CAE.
Author
Aeroelasticity; Computational Fluid Dynamics; Dynamic Structural Analysis; Unsteady Aerodynamics; Mathematical Models

20030063166 NASA Langley Research Center, Hampton, VA, USA
Active Control of Separation From the Flap of a Supercritical Airfoil
Melton, La Tunia Pack; Yao, Chung-Sheng; Seifert, Avi; January 2003; 13 pp.; In English; 33rd AIAA Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-4005; Copyright; Avail: CASI; A03, Hardcopy

Active flow control in the form of periodic zero-mass-flux excitation was applied at several regions on the leading edge and trailing edge flaps of a simplified high-lift system t o delay flow separation. The NASA Energy Efficient Transport (EET) supercritical airfoil was equipped with a 15\% chord simply hinged leading edge flap and a 25\% chord simply hinged trailing edge flap. Detailed flow features were measured in an attempt to identify optimal actuator placement. The measurements included steady and unsteady model and tunnel wall pressures, wake surveys, arrays of surface hot-films, flow visualization, and particle image velocimetry (PIV). The current paper describes the application of active separation control at several locations on the deflected trailing edge flap. High frequency (F(+) approx.= 10) and low frequency amplitude modulation (F(+)AM approx.= 1) of the high frequency excitation were used for control. Preliminary efforts to combine leading and trailing edge flap excitations are also reported.
Author
Active Control; Supercritical Flow; Airfoils; Trailing Edge Flaps; Boundary Layer Separation; Flow Distribution

20030063176 NASA Langley Research Center, Hampton, VA, USA
Effect of Sub-Boundary Layer Vortex Generations on Incident Turbulence
Casper, J.; Lin, J. C.; Yao, C. S.; [2003]; 15 pp.; In English; 33rd Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-4162; No Copyright; Avail: CASI; A03, Hardcopy

Sub-boundary layer vortex generators were tested in a wind tunnel to assess their effect on the velocity field within the wake region of a turbulent boundary layer. Both mean flow quantities and turbulence statistics were measured. Although very small relative to the boundary layer thickness, these so-called micro vortex generators were found to have a measurable effect on the power spectra and integral length scales of the turbulence at a distance many times the height of the devices themselves. In addition, the potential acoustic impact of these devices is also discussed. Measured turbulence spectra are used as input to an acoustic formulation in a manner that compares predicted sound pressure levels that result from the incident boundary-layer turbulence, with and without the vortex generators in the flow.
Author
Turbulent Boundary Layer; Vortex Generators; Boundary Layer Thickness; Wakes

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20030062088 NASA Glenn Research Center, Cleveland, OH, USA
Transient Growth Theory Prediction of Optimal Placing of Passive and Active Flow Control Devices for Separation Delay in LPT Airfoils
Tumin, Anatoli; Ashpis, David E.; May 2003; 24 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-991; WBS 22-274-00
Report No.(s): NASA/TM-2003-212228; E-13848; NAS 1.15:212228; Copyright; Avail: CASI; A03, Hardcopy

An analysis of the non-modal growth of perturbations in a boundary layer in the presence of a streamwise pressure gradient is presented. The analysis is based on PSE equations for an incompressible fluid. Examples with Falkner-Skan profiles indicate that a favorable pressure gradient decreases the non-modal growth while an unfavorable pressure gradient leads to an increase of the amplification. It is suggested that the transient growth mechanism be utilized to choose optimal parameters of tripping elements on a low-pressure turbine (LPT) airfoil. As an example, a boundary layer flow with a streamwise pressure gradient corresponding to the pressure distribution over a LPT airfoil is considered. It is shown that there is an optimal spacing of the tripping elements and that the transient growth effect depends on the starting point. At very low Reynolds numbers, there is a possibility to enhance the transient energy growth by means of wall cooling.
Author
Turbine Engines; Low Pressure; Airfoils; Turbomachinery; Separated Flow; Vortex Generators; Control Equipment; Flow Stability

20030062756 Ohio Aerospace Inst., Brook Park, OH, USA
A Preliminary Study of Ice-Accretion Scaling for SLD Conditions
Anderson, David N.; June 2003; 16 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-884; WU 708-20-13
Report No.(s): NASA/CR-2003-211824; AIAA Paper 2002-0521; NAS 1.26:211824; E-13516; No Copyright; Avail: CASI; A03, Hardcopy

Proposed changes to aircraft icing certification rules are being considered by European, Canadian, and American regulatory agencies to include operation in super-cooled large droplet conditions (SLD). This paper reports results of an experimental study in the NASA Glenn Icing Research Tunnel (IRT) to evaluate how well scaling methods developed for Appendix C conditions might apply to SLD conditions. Until now, scaling studies have been confined to the FAA FAR-25 Appendix C envelope of atmospheric cloud conditions. Tests were made in which it was attempted to scale to a droplet MVD of 50 microns from clouds having droplet MVDs of 175, 120, 100, and 70 microns. Scaling was based on the Ruff method with scale velocities found either by maintaining constant Weber number or by using the average of the velocities obtained by maintaining constant Weber number and constant Reynolds number. Models were unswept NACA 0012 wing sections. The reference model had a chord of 91.4 cm. Scale models had chords of 91.4, 80.0, and 53.3 cm. Tests were conducted with reference airspeeds of 100 and 150 kt (52 and 77 m/s) and with freezing fractions of 1.0, 0.6, and 0.3. It was demonstrated that the scaled 50-micron cloud simulated well the non-dimensional ice shapes accreted in clouds with MVD's of 120 microns or less.
Author
Aircraft Icing; Aircraft Safety; Ice Formation; Scale Models; Drops (Liquids)

20030062833 Purdue Univ., West Lafayette, IN
Unsteady Aerodynamics & Aeormechanics of Multi-Stage Turbomachinery Blading
Fleeter, Sanford; Nov. 30, 2002; 200 pp.; In English
Contract(s)/Grant(s): F49620-97-1-0009
Report No.(s): AD-A412022; AFRL-SR-AR-TR-03-0065; No Copyright; Avail: CASI; A09, Hardcopy

The overall research objective was to develop the technology needed to predict accurately significant blade row forced response in a multistage environment, thereby providing accurate predictions of HCF in turbine engine blade rows. Specific objectives included: development of a benchmark standard multistage transonic research compressor; providing a quantitative understanding and predictive capability for multi-stage blade row forced response; investigating techniques to control the flow induced vibrations; considering the issue of robustness including the role of variability and fluid structure interactions.
DTIC
Unsteady Aerodynamics; Prediction Analysis Techniques; Vibration

20030062904 Glasgow Univ., UK
Investigation of the Orthogonal Blade-Vortex Interaction
Early, J. M.; Green, R. S.; Nov. 30, 2002; 8 pp.; In English
Contract(s)/Grant(s): N62558-02-M-6011
Report No.(s): AD-A411568; GU-AERO-0210; No Copyright; Avail: CASI; A02, Hardcopy

Steps towards the implementation of a stereoscopic particle image velocimetry (PIV) system for the investigation of the orthogonal blade-vortex interaction are described. The design of the stereo PIV system used is described, and details of the Scheimpflug camera mounts are provided. The necessary changes to the image capture and calibration procedures are described, and brief details of the stereo PIV analysis are given. This is essential preparatory work for the experimental study of the orthogonal blade-vortex interaction using stereoscopic PIV to take place later in this project.
DTIC
Vortices; Blades; Orthogonality; Aerodynamics; Particle Image Velocimetry; Blade-Vortex Interaction

20030062912 Ohio Aerospace Inst., Brook Park, OH, USA
Measurement and Correlation of Ice Accretion Roughness
Anderson, David N.; Hentschel, Daniel B.; Ruff, Gary A.; June 2003; 19 pp.; In English; 36th Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2043; NCC3-884; WU 708-20-13
Report No.(s): NASA/CR-2003-211823; E-13515; NAS 1.26:211823; AIAA Paper 98-0486; No Copyright; Avail: CASI; A03, Hardcopy

Measurements were taken of the roughness characteristics of ice accreted on NACA 0012 airfoils in the NASA Glenn Icing Research Tunnel (IRT). Tests were conducted with size scaled, using models with chords of 26.7, 53.3, and 80.0 cm, and with liquid-water content scaled, both according to previously-tested scaling methods. The width of the smooth zone which forms on either side of the leading edge of the airfoil and the diameter of the roughness elements are presented in non-dimensional form as functions of the accumulation parameter. The smooth-zone width was found to decrease with increasing accumulation parameter. The roughness-element diameter increased with accumulation parameter until a plateau was reached. This maximum diameter was about 0.06 times twice the model leading-edge radius. Neither smooth-zone width nor element diameter were affected by a change in freezing fraction from 0.2 to 0.4. Both roughness characteristics appeared to scale with model size and with liquid-water content.
Author
Aircraft Safety; Aircraft Icing; Ice; Surface Roughness; Mechanical Properties; Cryogenic Wind Tunnels; Wind Tunnel Tests

20030062916 Stanford Univ., Stanford, CA
UAV Aeroelastic Control Using Redundant Micro-Actuators
Kroo, Ilan; Prinz, Fritz; Eaton, John; Mar. 3, 2003; 15 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0129
Report No.(s): AD-A412146; AFRL-SR-AR-TR-03-0078; No Copyright; Avail: CASI; A03, Hardcopy

The investigation of trailing edge micro-actuators for aeroelastic control of uninhabited air vehicles (UAVs) has ranged from examining the fundamental aerodynamic effects to demonstrating flutter suppression of a flexible wing. The applicability of aerodynamic prediction methods including CFD and panel methods has been studied. Several generations of actuator concepts have been developed and characterized. Wind tunnel experiments have been completed on a rigid wing to determine the aerodynamic performance of the various actuator concepts including the effects of deflection pattern and rate. Unsteady wind tunnel investigations with Particle Image Velocimetry have been completed to gain insight into the flow physics. An elastically scaled flexible wind tunnel model was fabricated, instrumented, and equipped with several actuators. Active flutter suppression of the flexible model was accomplished using the micro-actuators. This report summarizes the completed research program and highlights potential areas for further investigation.
DTIC
Aeroelasticity; Actuators; Particle Image Velocimetry

20030063032 NASA Langley Research Center, Hampton, VA, USA
Test Activities in the Langley Transonic Dynamics Tunnel and a Summary of Recent Facility Improvements
Cole, Stanley R.; Johnson, R. Keith; Piatak, David J.; Florance, Jennifer P.; Rivera, Jose A., Jr.; [2003]; 15 pp.; In English; AIAA Dynamics Specialists Conference, 9-10 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1958; No Copyright; Avail: CASI; A03, Hardcopy

The Langley Transonic Dynamics Tunnel (TDT) has provided a unique capability for aeroelastic testing for over forty years. The facility has a rich history of significant contributions to the design of many USA commercial transports, military aircraft, launch vehicles, and spacecraft. The facility has many features that contribute to its uniqueness for aeroelasticity testing, perhaps the most important feature being the use of a heavy gas test medium to achieve higher test densities compared to testing in air. Higher test medium densities substantially improve model-building requirements and therefore simplify the fabrication process for building aeroelastically scaled wind tunnel models. This paper describes TDT capabilities that make it particularly suited for aeroelasticity testing. The paper also discusses the nature of recent test activities in the TDT, including summaries of several specific tests. Finally, the paper documents recent facility improvement projects and the continuous statistical quality assessment effort for the TDT.
Author
Transonic Wind Tunnels; Wind Tunnel Tests; Aeroelasticity

20030063059 Texas Univ., Austin, TX, USA
Exploratory Experimental Study of Transitional Shock Wave Boundary Layer Interactions
Dolling, D. S.; Clemens, N. C.; Hood, E.; Jan. 31, 2003; 11 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0109
Report No.(s): AD-A411523; AFRL-SR-AR-TR-03-0046; No Copyright; Avail: CASI; A03, Hardcopy

An exploratory investigation has been made of transitional shock wave boundary layer interactions. In this case, the interaction is induced by a circular cylinder perpendicular to a flat plate. The tests were conducted in the Mach 5 blowdown

tunnel of The University of Texas at Austin. The primary goal of this initial, exploratory study was to determine if repeatable transitional interactions could be generated. Measurements included surface flow visualization using the kerosene-lampblack technique and high speed schlieren imaging. Consistent with earlier experiments the current work shows that as the cylinder is shifted upstream on the plate and the interaction start moves into an area where the incoming boundary layer is transitional, rather than turbulent, the separated flow and overall interaction scales increase significantly.
DTIC
Turbulent Flow; Boundary Layers; Cylinders; Flat Plates; Wind Tunnel Tests; Boundary Layer Transition

20030063079 Army Aviation Systems Command, Moffett Field, CA, USA
CFD Simulations of Tiltrotor Configurations in Hover
Potsdam, Mark a.; Strawn, Roger C.; [2002]; 16 pp.; In English; American Helicopter Society Forum, 11-13 Jun. 2002, Montreal, Quebec, Canada; No Copyright; Avail: CASI; A03, Hardcopy

Navier-Stokes computational fluid dynamics calculations are presented for isolated, half-span, and full-span V-22 tiltrotor hover configurations. These computational results extend the validity of CFD hover methodology beyond conventional rotorcraft applications to tiltrotor configurations. Computed steady-state, isolated rotor performance agrees well with experimental measurements, showing little sensitivity to grid resolution. However, blade-vortex interaction flowfield details are sensitive to numerical dissipation and are more difficult to model accurately. Time-dependent, dynamic, half- and full-span installed configurations show sensitivities in performance to the tiltrotor fountain flow. As such, the full-span configuration exhibits higher rotor performance and lower airframe download than the half-span configuration. Half-span rotor installation trends match available half-span data, and airframe downloads are reasonably well predicted. Overall, the CFD solutions provide a wealth of flowfield details that can be used to analyze and improve tiltrotor aerodynamic performance.
Author
Navier-Stokes Equation; Computational Fluid Dynamics; Aerodynamic Characteristics; Aerodynamic Configurations; Tilt Rotor Aircraft; Flow Distribution; Aerodynamic Loads

20030063156 NASA Langley Research Center, Hampton, VA, USA
Summary of Available Data Relating to Reynolds Number Effects on the Maximum Lift Coefficients of Swept-Back Wings
Sweberg, Harold H.; Lange, Roy H.; March 4, 1947; 21 pp.; In English
Report No.(s): NACA-RM-L6L20a; No Copyright; Avail: CASI; A03, Hardcopy

The available foreign and American data relating to Reynolds number effects on the maximum lift coefficients of swept-back wings are summarized and discussed. The data show that at low Reynolds numbers (below about 2.0 x 10(exp 6)) higher maximum lift coefficients were measured in most cases for moderately swept-back wings than for unswept wings of similar plan form; at high Reynolds numbers, however, increasing sweepback resulted in decreasing maximum lift coefficients. A smaller rate of increase of the maximum lift coefficient with Reynolds number was measured for the swept-back wings than for similar unswept wings in the critical range of Reynolds number. Increasing the Reynolds number resulted in decreases in the maximum lift coefficients of the two wings of approximately triangular plan form that were investigated.
Author
High Reynolds Number; Low Reynolds Number; Aerodynamic Coefficients; Swept Wings; Unswept Wings; Aerodynamic Characteristics; Wind Tunnel Tests; Airfoils; Aerodynamic Configurations

20030063170 MARINE CORPS COMMAND AND STAFF COLL QUANTICO VA, Quantico, VA, USA
Strategic and Operational Relevance of Heavy Lift in the USA Marine Corps: CH-53E Program
McLellan, Archibald M.; Jan. 2002; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411615; No Copyright; Avail: CASI; A04, Hardcopy

This essay examines the strategic and operational relevance of the heavy lift capability in the USA Marine Corps. The only way to truly realize the full potential of Expeditionary Maneuver Warfare (EMW) and the capabilities of the MV-22, is to maintain the existing synergistic relationship between the medium and heavy lift aircraft working together to accomplish the mission. In current future plans the MV-22 will be required to carry external loads for 48 percent of its sorties in the movement of a Regimental Landing Team (RLT). This minimizes the speed advantage of the MV-22, as the limitations inherent with external loads (increased drag, load instability and integrity), prevent taking most external loads out toward the maximum speed of the MV-22. Accordingly, the best alternative to ensuring that we preserve the MV-22 speed advantage is to ensure there are adequate numbers of CH-53E helicopters to perform all the majority of external lift missions. If the Marine

Corps changed the current ratio of medium lift to heavy lift aircraft from 3:1 to 2:1 i.e. by adding two CH-53E's to the current MEU, increasing the number of CH-53E's (to six) we would see a 20 percent reduction in total waves and a 22 percent decrease in time required to accomplish a reinforced Company movement. In the future changing the force ratio from 2:1 to 1:1 (medium to heavy), the CH-53E (SLEP) has the potential to provide a significant improvement in the ability to move the force. There is the potential for a 28 percent decrease in sorties required to accomplish a Regimental Landing Team movement by air and an overall timesaving of 29 percent in addition to the already realized savings of 25 percent from balancing the force with today's CH-53E. The projected force structure will not be capable of supporting the concepts of Expeditionary Maneuver Warfare, STOM and OMFTS without 100 percent utilization of all of the CH-53E assets forecast to be in the inventory.
DTIC
Helicopters; Loads (Forces)

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20030063006 NASA Langley Research Center, Hampton, VA, USA
Atmospheric Ionizing Radiation and the High Speed Civil Transport, Chapter 1
Maiden, D. L.; Wilson, J. W.; Jones, I. W.; Goldhagen, P.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 1-25; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Atmospheric ionizing radiation is produced by extraterrestrial radiations incident on the Earth's atmosphere. These extraterrestrial radiations are of two sources: ever present galactic cosmic rays with origin outside the solar system and transient solar particle events that are at times very intense events associated with solar activity lasting several hours to a few days. Although the galactic radiation penetrating through the atmosphere to the ground is low in intensity, the intensity is more than two orders of magnitude greater at commercial aircraft altitudes. The radiation levels at the higher altitudes of the High Speed Civil Transport (HSCT) are an additional factor of two higher. Ionizing radiation produces chemically active radicals in biological tissues that alter the cell function or result in cell death. Protection standards against low levels of ionizing radiation are based on limitation of excess cancer mortality or limitation of developmental injury resulting in permanent damage to the offspring during pregnancy. The crews of commercial air transport operations are considered as radiation workers by the EPA, the FAA, and the International Commission on Radiological Protection (ICRP). The annual exposures of aircrews depend on the latitudes and altitudes of operation and flight time. Flight hours have significantly increased since deregulation of the airline industry in the 1980's. The FAA estimates annual subsonic aircrew exposures to range from 0.2 to 9.1 mSv compared to 0.5 mSv exposure of the average nuclear power plant worker in the nuclear industry. The commercial aircrews of the HSCT may receive exposures above recently recommended allowable limits for even radiation workers if flying their allowable number of flight hours. An adequate protection philosophy for background exposures in HSCT commercial airtraffic cannot be developed at this time due to current uncertainty in environmental levels. In addition, if a large solar particle event occurs during flight at HSCT altitudes then passengers and crew may greatly exceed allowable limits unless means are available to reduce exposures.
Author
Atmospheric Radiation; Ionizing Radiation; Extraterrestrial Radiation; Flight Crews; Supersonic Transports

20030063064 Nebraska Univ., Omaha, NE, USA
The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3
Lee, Yeong-Heok, Editor; Bowen, Brent D., Editor; Tarry, Scott E., Editor; July 2001; 213 pp.; In English; Air Transport Research Society (ATRS) 5th International Conference on Air Transportation Operations and Policy, 19-21 Jul. 2001, Jeju Island, Korea, Republic of; See also 20030063065 - 20030063072
Report No.(s): UNOAI-01-8-Vol-3; Copyright; Avail: CASI; A10, Hardcopy

The papers presented at this conference include: 1) The Global Airline Company: Agent of Market Power or Competition? 2) Airport Pavement Management; 3) Reservation System Providers and the Impact of Codeshare Arrangements on Screen Display; 4) Strategic Classification of Current Airline Alliances and Examination of Critical Factors Involving the Formations

- an Explorative Perspective; 5) Airport Privatization Policy and Performance Measurement in Korea; 6) Pilot and Air Traffic Controller Relationships: The Role of Interdependence and Relative Influence; 7) Liberalization of Air Cargo Services: Background and an Economic Analysis; 8) The Implication of Hub and Spoke Network on the Airline Alliance Strategy.
CASI
Air Transportation; Airline Operations; Air Traffic; Economic Analysis; Government/Industry Relations; Economic Factors

20030063065 Embry-Riddle Aeronautical Univ., FL, USA
Electronic Reservation System Providers and the Impact of Codeshare Arrangements on Screen Display
Waguespack, Blaise P.; Thornton, Todd L.; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-33; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

Airline code-share agreements in both the U.S. domestic market and international market are playing a significant role in the marketing strategies developed to win market share. Additionally, airlines are examining a wide range of electronic distribution channels in an effort to control costs and serve customers. This paper examines how codeshare agreements came into existence and the effect of codeshares on computer reservation system displays. Finally, the paper examines the results of a structured investigation of airline display patterns on leading electronic reservation system providers (ERSP) and the presence of codeshare arrangements on the screen displays consumers have to examine.
Author
Airports; Civil Aviation; Marketing; Computer Systems Programs; Display Devices

20030063066 City Univ. of Hong Kong, Kowloon, Hong Kong
Liberalization of Air Cargo Services: Background and an Economic Analysis
Zhang, Anming; Zhang, Yimin; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-25; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

This paper provides a background discussion and economic analysis on the liberalization of air cargo services in international aviation. It shows that all-cargo carriers may have different routing needs than passenger carriers and thus require different sets of air traffic rights from those needed by passenger carriers. On the other hand, separation of air cargo and passenger rights will be fraught with difficulty in Asia because of distinctive characteristics of its air cargo market, where most passenger carriers have substantial cargo business and operate combination fleets.
Author
Air Cargo; Economic Analysis; Air Transportation; International Relations

20030063069 Southern Cross Univ., New South Wales, Australia
Strategic Classification of Current Airline Alliances and Examination of Critical Factors Involving the Formations - an Explorative Perspective
Wang, Zhi H.; Evans, Michael; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-30; In English; See also 20030063064; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

This research identifies several categories of airline alliances through a strategic classification of various alliance activities involving the major airlines for the period 1989 to 1999. Such a classification enables this research to examine how strategic alliances are developing in the markets of North America, the European Union and the Asia Pacific regions, and what are the critical factors involved with a formation and development of alliances. Findings support the argument that the liberalization process, being different between countries, can affect airlines of these countries entering different types of airline alliances. This exploratory study facilitates research undertaken by the researchers to further examine effects and consequences of different types of the airline alliances.
Author
Airline Operations; Civil Aviation; Market Research; Air Transportation

20030063071 Hankuk Aviation Univ., Kyunggido, Korea, Republic of
Pilot and Air Traffic Controller Relationships: The Role of Interdependence and Relative Influence
Young, Kim Chl; Won, Kang In; Chul, Choi Youn; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-13; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

There have been many studies which revealed most of the accidents related to pilot errors. Looking at each phase of flights, the accidents which occurred at the segments of take-off and landing consist of 70\%, because these phases need precise cooperations between pilots and ATC specialists to make sure every instructions understood and instruments to be normal. Therefore, the accidents of these phases leave great regrets and the price was enormous to people and equipments. Until now, most of the studies investigate the accident itself and very few show the relationships between pilots and air traffic controllers. This study analyzes the impacts of inter-dependence to mutual trust, cooperations and relationship efficiency between them who play important parts in flight. Based upon the findings, the inter-dependence has an effect on mutual trust and the latter influences to cooperations. Also, mutual trust and cooperations have a leading role in the relationship efficiency. It implies that mutual trust, cooperations, and the degree of inter-dependence are important factors to improve the relationships between them.
Author
Air Traffic Controllers (Personnel); Aircraft Pilots; Employee Relations; Aircraft Performance

20030063075 Army Aviation and Missile Command, Moffett Field, CA, USA
An Obstacle Alerting System for Agricultural Application
DeMaio, Joe; [2003]; 13 pp.; In English; American Helicopter Society International Forum, 11-13 Jun. 2002, Montreal, Quebec, Canada; No Copyright; Avail: CASI; A03, Hardcopy

Wire strikes are a significant cause of helicopter accidents. The aircraft most at risk are aerial applicators. The present study examines the effectiveness of a wire alert delivered by way of the lightbar, a GPS-based guidance system for aerial application. The alert lead-time needed to avoid an invisible wire is compared with that to avoid a visible wire. A flight simulator was configured to simulate an agricultural application helicopter. Two pilots flew simulated spray runs in fields with visible wires, invisible wires, and no wires. The wire alert was effective in reducing wire strikes. A lead-time of 3.5 sec was required for the alert to be effective. The lead- time required was the same whether the pilot could see the wire or not.
Author
Aircraft Accidents; Accident Prevention; Wire; Airborne Equipment; Flight Simulators; Warning Systems

20030063078 NASA Ames Research Center, Moffett Field, CA, USA
Analysis of US Civil Rotorcraft Accidents from 1990 to 1996 and Implications for a Safety Program
Iseler, Laura; DeMaio, Joe; [2001]; 8 pp.; In English; American Helicopter Society 57th Annual Forum, 9-11 May 2001, Washington, DC, USA
Contract(s)/Grant(s): RTOP 712-31-00; No Copyright; Avail: CASI; A02, Hardcopy

A NASA Ames Research Center analysis of rotorcraft accident data identified safety issues that could lead to a reduction in accidents. The primary source of data was summaries of National Transportation Safety Board (NTSB) accident reports. Lower cost helicopters have more accidents than do higher cost helicopters, despite flying fewer total hours, but they have less-serious accidents. The most dramatic division in rotorcraft accidents is between private pilots and professional pilots. Private pilots have more accidents per flight hour than professionals. Pilot error plays a prominent role across the board as either a main cause or contributing factor. Judgement error, in particular, is more likely to lead to a fatal accident than are other types of causes. Accidents with private pilots and those with professional pilots require different solutions. NASA's near term approach to improving rotorcraft safety addresses improving the capability of the private pilot. NASA is doing this by providing training aids to flight schools and using the internet to distribute safety information via a safety website. The site NASA has created contains helpful information that was previously difficult to find in one location. NASA will develop computerized training modules to be used in conjunction with ground and flight instruction. These two projects, the website and training modules, are aimed at raising safety awareness and increasing pilots' comprehension of helicopter operations.
Author
Rotary Wing Aircraft; Aircraft Accidents; Accident Prevention; Pilot Performance; Information Analysis; Safety Management; Information Dissemination

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20030062131 NASA Langley Research Center, Hampton, VA, USA
Summary of Fluidic Thrust Vectoring Research Conducted at NASA Langley Research Center
Deere, Karen A.; [2003]; 18 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3800; No Copyright; Avail: CASI; A03, Hardcopy

Interest in low-observable aircraft and in lowering an aircraft's exhaust system weight sparked decades of research for fixed geometry exhaust nozzles. The desire for such integrated exhaust nozzles was the catalyst for new fluidic control techniques; including throat area control, expansion control, and thrust-vector angle control. This paper summarizes a variety of fluidic thrust vectoring concepts that have been tested both experimentally and computationally at NASA Langley Research Center. The nozzle concepts are divided into three categories according to the method used for fluidic thrust vectoring: the shock vector control method, the throat shifting method, and the counterflow method. This paper explains the thrust vectoring mechanism for each fluidic method, provides examples of configurations tested for each method, and discusses the advantages and disadvantages of each method.
Author
Exhaust Nozzles; Thrust Vector Control; Fluidics; Control Systems Design; Exhaust Systems

20030062146 Southwest Research Inst., San Antonio, TX
Impact of Parameter Variation on Damage Tolerance Analysis Estimates
Wieland, David H.; Millwater, Harry; Nov. 2002; 57 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412033; SWRI-18.04064; AFRL-VA-WP-TR-2002-3089; No Copyright; Avail: CASI; A04, Hardcopy

This study was conducted to determine the effects of variations in damage tolerance analysis parameters on fatigue crack growth life. The damage tolerance analysis with variations in input parameters was performed at fatigue critical locations in two different aircraft types using probabilistic sensitivity analysis methods. Up to 12 input parameters. The geometry correction factors, stress spectrum scale factor and stress intensity factor values were found to affect the damage tolerance analysis estimates.
DTIC
Crack Propagation; Impact Tolerances

20030062148 Karta Technology, Inc., San Antonio, TX
Aircraft/Auxiliary Power Units/Aerospace Ground Support Equipment Emission Factors
Wade, Mark D.; Oct. 2002; 68 pp.; In English
Report No.(s): AD-A412045; IERA-RS-BR-SR-2003-0002; No Copyright; Avail: CASI; A04, Hardcopy

The report provides aircraft engine, auxiliary power unit, and ground support equipment operation information and emission factors for military and commercial aircraft operations. This data has been provided in a format that can be used to calculate Air Force runway emissions for military and commercial aircraft, auxiliary power units, and ground support equipment. The organization calculating the emissions will still need to determine average atmospheric mixing heights and landing/takeoff number and time parameters.
DTIC
Aircraft Engines; Ground Support Equipment

20030062153 NASA Langley Research Center, Hampton, VA, USA
Advances in Pneumatic-Controlled High-Lift Systems Through Pulsed Blowing
Jones, Gregory S.; Englar, Robet J.; [2003]; 15 pp.; In English; 21st Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3411; Copyright; Avail: CASI; A03, Hardcopy

Circulation Control technologies have been around for 65 years, and have been successfully demonstrated in laboratories and flight vehicles alike. Yet there are few production aircraft flying today that implement these advances. Circulation Control techniques may have been overlooked due to perceived unfavorable trade offs of mass flow, pitching moment, cruise drag,

noise, etc. Improvements in certain aspects of Circulation Control technology are the focus of this paper. This report will describe airfoil and blown high lift concepts that also address cruise drag reduction and reductions in mass flow through the use of pulsed pneumatic blowing on a Coanda surface. Pulsed concepts demonstrate significant reductions in mass flow requirements for Circulation Control, as well as cruise drag concepts that equal or exceed conventional airfoil systems.
Author
Control Systems Design; Pitching Moments; Airfoils; Blowing; Mass Flow; Drag Reduction

20030062761 NASA Marshall Space Flight Center, Huntsville, AL, USA
Off-Design Performance of a Multi-Stage Supersonic Turbine
Dorney, Daniel J.; Griffin, Lisa W.; Huber, Frank; Sondak, Douglas L.; [2003]; 24 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Report No.(s): AIAA Paper 2003-1212; Copyright; Avail: CASI; A03, Hardcopy

The drive towards high-work turbines has led to designs which can be compact, transonic, supersonic, counter rotating, or use a dense drive gas. These aggressive designs can lead to strong unsteady secondary flows and flow separation. The amplitude and extent of these unsteady flow phenomena can be amplified at off-design operating conditions. Pre-test off-design predictions have been performed for a new two-stage supersonic turbine design that is currently being tested in air. The simulations were performed using a three-dimensional unsteady Navier-Stokes analysis, and the predicted results have been compared with solutions from a validated meanline analysis.
Author
Supersonic Turbines; Two Stage Turbines; Aircraft Design; Computational Fluid Dynamics; Rotor Aerodynamics; Computerized Simulation; Aircraft Performance

20030062762 NASA Marshall Space Flight Center, Huntsville, AL, USA, Riverbend Design Services, USA
Turbine Aerodynamic Design System Improvements
Huber, Frank W.; Griffin, Lisa W.; Simpson, Steven P.; April 1, 2003; 27 pp.; In English; MSFC Spring Fluids Workshop, 22-24 Apr. 2003, Birmingham, AL, USA
Contract(s)/Grant(s): NASA Order H-35543-D; No Copyright; Avail: CASI; A03, Hardcopy

Presentation outline includes the following: 1. Volute manifold design and analysis methodology. 2. Meanline modification for compatibility with engine analysis code. Objective is to develop a manifold design methodology for turbines and pumps, and to enable rapid screening of candidate flow paths.
CASI
Aerodynamics; Turbines; Design Analysis

20030062966 NASA Ames Research Center, Moffett Field, CA, USA
Initial Flight Evaluation of the Army/NASA RASCAL Variable Stability Helicopter
Moralez, Ernesto, III; Hindson, William S.; Arterburn, David R.; September 18, 2000; 5 pp.; In English; American Helicopter Society 57th Annual Forum, 9-11 May 2001, Washington, DC, USA; No Copyright; Avail: CASI; A01, Hardcopy

NASA Ames Research Center and the U.S. Army Aeroflightdynamics Directorate (AFDD) [will] have performed initial flight evaluations of the Research Flight Control System (RFCS) that has been integrated into the Army/NASA Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL) variable stability helicopter. The RASCAL, a highly modified JUH-60A Black Hawk helicopter, is a variable-stability, in-flight simulator that is designed to support flight research programs that leverage on the flight control and handling qualities design tools developed by the Army and NASA. These tools are used in the flight control design life cycle from initial concept definition, through simulation, and ultimately into flight on-board the RASCAL helicopter. The RASCAL will be used to validate methodologies for reducing design cycle costs for new or modified aircraft, and it will serve as a base for the investigation of new rotorcraft technology.
Author
Rotary Wing Aircraft; Flight Tests; Helicopter Design; Life (Durability); Uh-60a Helicopter

20030062967 NASA Ames Research Center, Moffett Field, CA, USA
Effects of Rotor Design Variations on Tiltrotor Whirl-Mode Stability
Acree, C. W., Jr.; [2000]; 3 pp.; In English; Tiltrotor/Runway Independent Aircraft Technology and Applications Specialists' Meeting, March. 2001, Arlington, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy

Further increases in tiltrotor speeds are limited by coupled wing/rotor whirl-mode aeroelastic instability. Increased power,

thrust, and efficiency are not enough: the whirl-mode stability boundary must also be improved. With current technology, very stiff, thick wings of limited aspect ratio are essential to meet the stability requirements, which severely limits cruise efficiency and maximum speed. Larger and more efficient tiltrotors will need longer and lighter wings, for which whirl-mode flutter is a serious design issue. Numerous approaches to improving the whirl-mode airspeed boundary have been investigated, typically focusing on wing design, active stability augmentation, and variable geometry rotors. The research reported herein applies the much simpler approach of sweeping the outboard blade sections. The effects-of control-system stiffness were also studied. Reference covers the first phase of the current research and discusses the evolution of the concept.
Author
Airspeed; Rotary Stability; Rotor Aerodynamics; Stability Augmentation; Tilt Rotor Aircraft

20030063025 NASA Ames Research Center, Moffett Field, CA, USA
The SOFIA Aircraft and its Modification
Kunz, Nans; May 1, 2002; 2 pp.; In English; International Society for Optical Engineering Conference, 22-28 Aug. 2002, Waikoloa, HI, USA
Contract(s)/Grant(s): 263-10-00; No Copyright; Avail: Other Sources; Abstract Only

The primary focus of this paper is to describe the challenges involved in creating this highly modified aircraft that carries a twenty ton telescope to the Stratosphere and then loiters at this desired altitude to act as the observatory 'dome' or platform. When the aircraft has reached its nominal cruise condition in the stratosphere of Mach 0.84, a large cavity door opens (the dome opens), exposing a large portion of the interior of the fuselage containing the telescope optics, directly to the Universe. The breadth of topics covered in this paper includes; the relevant criteria and the evaluation process that resulted in the selection of a Boeing 747-SP, the evolution of the design concept, a description of the structural modification including the analysis methods and tools, the aerodynamic issues associated with an open port cavity and how they were addressed, the aero-loads/disturbances imparted to the telescope and how they were measured in the wind tunnel and extrapolated to full size. For completeness, this paper also provides a brief overview of the SOFIA project including the joint project arrangement between NASA and DLR, a top level overview of the science objectives and the resulting requirements, and finally the current project status.
Author
Sofia (Airborne Observatory); Observatories; Telescopes; Fuselages; Boeing 747 Aircraft

20030063035 NASA Ames Research Center, Moffett Field, CA, USA
Neural Network Based Representation of UH-60A Pilot and Hub Accelerations
Kottapalli, Sesi; [2000]; 18 pp.; In English; American Helicopter Society Aeromechanics Specialists Meeting, 13-14 Nov. 2000, Atlanta, GA, USA
Contract(s)/Grant(s): RTOP 712-10-12; No Copyright; Avail: CASI; A03, Hardcopy

Neural network relationships between the full-scale, experimental hub accelerations and the corresponding pilot floor vertical vibration are studied. The present physics-based, quantitative effort represents an initial systematic study on the UH-60A Black Hawk hub accelerations. The NASA/Army UH-60A Airloads Program flight test database was used. A 'maneuver-effect-factor (MEF)', derived using the roll-angle and the pitch-rate, was used. Three neural network based representation-cases were considered. The pilot floor vertical vibration was considered in the first case and the hub accelerations were separately considered in the second case. The third case considered both the hub accelerations and the pilot floor vertical vibration. Neither the advance ratio nor the gross weight alone could be used to predict the pilot floor vertical vibration. However, the advance ratio and the gross weight together could be used to predict the pilot floor vertical vibration over the entire flight envelope. The hub accelerations data were modeled and found to be of very acceptable quality. The hub accelerations alone could not be used to predict the pilot floor vertical vibration. Thus, the hub accelerations alone do not drive the pilot floor vertical vibration. However, the hub accelerations, along with either the advance ratio or the gross weight or both, could be used to satisfactorily predict the pilot floor vertical vibration. The hub accelerations are clearly a factor in determining the pilot floor vertical vibration.
Author
Neural Nets; Hubs; Uh-60a Helicopter; Vibratory Loads; Vibrational Stress; Mathematical Models; Aerodynamic Loads

20030063074 NASA Ames Research Center, Moffett Field, CA, USA
A Small-Scale Tiltrotor Model Operating in Descending Flight
Abrego, Anita I.; Betzina, Mark D.; Long, Kurtis R.; September 1, 2002; 4 pp.; In English; 28th European Rotorcraft Forum, 17-20 Sep. 2002, Bristol, UK; No Copyright; Avail: CASI; A01, Hardcopy

As a rotor s descent velocity in low speed flight approaches the induced wake velocity, a vortex ring is formed around the circumference of the rotor disk causing the flow to become very unsteady. This condition is known as Vortex Ring State (VRS). The aerodynamic Characteristics of edgewise operating rotors in this VRS induced environment have been studied for many years. In the 1960 s, two propellers were tested in vertical or near vertical descent, indicating a loss in thrust in the region of VRS. Thrust fluctuations of both single and tandem rotor configurations while operating in VRS were reported. More recently, the effects of descending flight on a single rotor operating in close proximity to a physical image plane, simulating the effects of a twin rotor tiltrotor system were investigated. Mean rotor thrust reductions and thrust fluctuations were shown in VRS. Results indicated the need to acquire additional data with a two-rotor model and the need to investigate the use of a single rotor/image plane apparatus to identify the characteristics of a two-rotor flowfield. As a result a small-scale tiltrotor model with 2-b1adedy untwisted, teetering rotors was tested at various states of descent and sideslip. Dual-rotor, single-rotor with image plane, and isolated-rotor results were reported, suggesting the single-rotor with image plane configuration may not properly capture the aerodynamic nature of a dual-rotor vehicle. Recommendations included additional testing of a model that better represents the physical characteristics of a tiltrotor aircraft. Specific recommendations for model improvements included using three-bladed rotors, twisted blades, a tiltrotor fuselage and wings.
Derived from text
Aerodynamic Characteristics; Tilt Rotor Aircraft; Vortex Rings; Scale Models

20030063077 Army Aviation Systems Command, Moffett Field, CA, USA
Airloads and Wake Geometry Calculations for an Isolated Tiltrotor Model in a Wind Tunnel
Johnson, Wayne; [2003]; 7 pp.; In English; 27th European Rotorcraft Forum, 11-14 Sep. 2001, Moscow, Russia; No Copyright; Avail: CASI; A02, Hardcopy

Th tiltrotor aircraft configuration has the potential to revolutionize air transportation by providing an economical combination of vertical take-off and landing capability with efficient, high-speed cruise flight. To achieve this potential it is necessary to have validated analytical tools that will support future tiltrotor aircraft development. These analytical tools must calculate tiltrotor aeromechanical behavior, including performance, structural loads, vibration, and aeroelastic stability, with an accuracy established by correlation with measured tiltrotor data. For many years such correlation has been performed for helicopter rotors (rotors designed for edgewise flight), but correlation activities for tiltrotors have been limited, in part by the absence of appropriate measured data. The recent test of the Tilt Rotor Aeroacoustic Model (TRAM) with a single, U4-scale V-22 rotor in the German-Dutch Wind Tunnel (DNW) now provides an extensive set of aeroacoustic, performance, and structural loads data. This paper will present calculations of airloads, wake geometry, and performance, including correlation with TRAM DNW measurements. The calculations were obtained using CAMRAD II, which is a modern rotorcraft comprehensive analysis, with advanced models intended for application to tiltrotor aircraft as well as helicopters. Comprehensive analyses have received extensive correlation with performance and loads measurements on helicopter rotors. The proposed paper is part of an initial effort to perform an equally extensive correlation with tiltrotor data. The correlation will establish the level of predictive capability achievable with current technology; identify the limitations of the current aerodynamic, wake, and structural models of tiltrotors; and lead to recommendations for research to extend tiltrotor aeromechanics analysis capability. The purpose of the Tilt Rotor Aeroacoustic Model (TRAM) experimental project is to provide data necessary to validate tiltrotor performance and aeroacoustic prediction methodologies and to investigate and demonstrate advanced civil tiltrotor technologies. The TRAM project is a key part of the NASA Short Haul Civil Tiltrotor (SHCT) project. The SHCT project is an element of the Aviation Systems Capacity Initiative within NASA. In April-May 1998 the TRAM was tested in the isolated rotor configuration at the Large Low-speed Facility of the German-Dutch Wind Tunnels (DNW). A preparatory test was conducted in December 1997. These tests were the first comprehensive aeroacoustic test for a tiltrotor, including not only noise and performance data, but airload and wake measurements as well. The TRAM can also be tested in a fill-span configuration, incorporating both rotors Lnd a fuselage model. The wind tunnel installation of the TRAM isolated rotor is shown. The rotor tested in the DNW was a 1/4-scale (9.5 ft diameter) model of the right-hand V-22 proprotor. The rotor and nacelle assembly was attached to an acoustically-treated, isolated rotor test stand through a mechanical pivot (the nacelle conversion axis). The TRAM was analyzed using the rotorcraft comprehensive analysis CAMRAD II. CAMRAD II is an aeromechanical analysis of helicopters and rotorcraft that incorporates a combination of advanced technologies, including multibody dynamics, nonlinear finite elements, and rotorcraft aerodynamics. The trim task finds the equilibrium solution (constant or periodic) for a steady state operating condition, in this case a rotor operating in a wind tunnel. For wind tunnel operation, the thrust and flapping are trimmed to target values. The aerodynamic model includes a wake analysis to calculate the rotor nonuniform induced-velocities, using a free wake geometry. The paper will present the results of CAMRAD II calculations compared to the TRAM DNW measurements for hover performance, helicopter mode performance, and helicopter mode airloads. An example of the hover performance results, comparing both mearements and

calculations for the JVX (large scale) and TRAM (small scale) rotors, is shown. An example of the helicopter mode performance, showing the influence of the aerodynamic model (particularly the stall delay model) on the calculated power, induced power, and profile power is also shown. An example of the helicopter mode airloads, showing the influence of various wake and aerodynamic models on the calculations, is shown. Good correlation with measured airloads is obtained using the multiple-trailer wake model. The paper will present additional results, and describe and discuss the aerodynamic behavior in detail.
Author
Tilt Rotor Aircraft; Aerodynamic Characteristics; Aerodynamic Loads; Wind Tunnel Tests; Wind Tunnel Models; Aeroelasticity; Tilting Rotors; Aerodynamic Stability

20030063155 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Tests of Submerged Duct Installation on the Ryan FR-1 Airplane in the Ames 40- by 80-Foot Wind Tunnel
Martin, Norman J.; April 23, 1947; 31 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7D14; No Copyright; Avail: CASI; A03, Hardcopy

An investigation of an NACA submerged intake installation on the Ryan FR-1 was conducted to determine the full-scale aerodynamic characteristics of this installation. In addition, tests were conducted on the submerged inlet with revised entrance lips and deflectors to determine the configuration which would result in the best dynamic pressure recovery measured at the inlet for this installation without a major rework of the entrance. Stalling of the air flow over the inner lip surface created excessive dynamic pressure losses with the original entrance. The revised entrance produced a 12-percent increase in dynamic pressure recovery at the design high-speed inlet-velocity ratio and resulted in an improvement of thte critical-speed characteristics of the entrance lip. A complete redesign of the entrance including a decrease in ramp angle and adjustment of lip camber is necessary to secure optimum results from this submerged duct installation.
Author
Wind Tunnel Tests; Aerodynamic Characteristics; Computational Fluid Dynamics; Intake Systems; Aerodynamic Configurations; Aircraft Design; Aerodynamic Forces; Ducts

20030063160 Army Aviation Systems Command, Moffett Field, CA, USA
Flight-Test Validation and Flying Qualities Evaluation of a Rotorcraft UAV Flight Control System
Mettler, Bernard; Tuschler, Mark B.; Kanade, Takeo; September 15, 2000; 3 pp.; In English; Unmanned Air Vehicle Systems Conference, 2-4 Apr. 2001, Bristol, UK; Copyright; Avail: CASI; A01, Hardcopy

This paper presents a process of design and flight-test validation and flying qualities evaluation of a flight control system for a rotorcraft-based unmanned aerial vehicle (RUAV). The keystone of this process is an accurate flight-dynamic model of the aircraft, derived by using system identification modeling. The model captures the most relevant dynamic features of our unmanned rotorcraft, and explicitly accounts for the presence of a stabilizer bar. Using the identified model we were able to determine the performance margins of our original control system and identify limiting factors. The performance limitations were addressed and the attitude control system was 0ptimize.d for different three performance levels: slow, medium, fast. The optimized control laws will be implemented in our RUAV. We will first determine the validity of our control design approach by flight test validating our optimized controllers. Subsequently, we will fly a series of maneuvers with the three optimized controllers to determine the level of flying qualities that can be attained. The outcome enable us to draw important conclusions on the flying qualities requirements for small-scale RUAVs.
Author
Pilotless Aircraft; Flight Tests; Flight Characteristics; Rotary Wing Aircraft; Aircraft Performance

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also *04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics*; and *35 Instrumentation and Photography*.

20030062990 Kiel Univ., Germany
Radiation Dose in Silicon Detectors on ER-2 Flights
Beaujean, R.; Kopp, J.; Reitz, G.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 227-233; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Based on two silicon detectors of 315 m thickness, the DOSTEL active dosemeter measured count and dose rates as well as Linear Energy Transfer (LET) spectra on ER-2 flights. The instrument was located close to the TACAN transmitter which induced noise background to the instrument except on the two southbound flights. These two flights showed periods of undisturbed measurements with valid data for the dose rate and the LET spectra. Using the effective quality factor of 1.9 deduced from the LET specta and the conversion factor of 1.2 from LET in silicon to LET in water the mean dose equivalent rate arrives at 3.7 microns Sv/h for the low latitude flights.
Author
Radiation Detectors; Silicon; U-2 Aircraft; Measuring Instruments; Radiation Dosage

20030062996 NASA Johnson Space Center, Houston, TX, USA
JSC Particle Telescope
Badhwar, G. D.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 237-240; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents a detailed description of the Johnson Space Center's Particle Telescope. Schematic diagrams of the telescope geometry and an electronic block diagram of the detector telescopes' components are also described.
CASI
Particle Telescopes; Spaceborne Telescopes; Systems Engineering; Aircraft Instruments

20030062997 NASA Langley Research Center, Hampton, VA, USA
AIR Model Preflight Analysis
Tai, H.; Wilson, J. W.; Maiden, D. L.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 121-146; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The atmospheric ionizing radiation (AIR) ER-2 preflight analysis, one of the first attempts to obtain a relatively complete measurement set of the high-altitude radiation level environment, is described in this paper. The primary thrust is to characterize the atmospheric radiation and to define dose levels at high-altitude flight. A secondary thrust is to develop and validate dosimetric techniques and monitoring devices for protecting aircrews. With a few chosen routes, we can measure the experimental results and validate the AIR model predictions. Eventually, as more measurements are made, we gain more understanding about the hazardous radiation environment and acquire more confidence in the prediction models.
Derived from text
Atmospheric Radiation; Ionizing Radiation; Preflight Analysis; U-2 Aircraft; High Altitude; Mathematical Models; Aircraft Instruments

20030062998 NASA Langley Research Center, Hampton, VA, USA
June 1997 ER-2 Flight Measurements
Jones, Irby W.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 147-163; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Within our current understanding of the atmospheric ionizing radiation, the ER-2 flight package was designed to provide a complete characterization of the physical fields and evaluate various dosimetric techniques for routine monitoring. A flight plan was developed to sample the full dynamic range of the atmospheric environment especially at altitudes relevant to the development of the High Speed Civil Transport. The flight of the instruments occurred in June of 1997 where predictive models indicated a maximum in the high altitude radiation environment occurring approximately nine months after the minimum in the solar sunspot cycle. The flights originated at Moffett field at the Ames Research Center on ER-2 aircraft designated as 706. The equipment was shipped mid- May 1997 for unpacking and checkout, size fitting, systems functional test, and preflight testing on aircraft power with flight readiness achieved on May 30, 1997. The equipment was qualified on its first engineering flight on June 2, 1997 and the subsequent science gathering flights followed during the period of June 5-15, 1997. Herein we give an account of the flight operations.
Author
Flight Operations; Instrument Packages; Civil Aviation; Flight Tests; Flight Characteristics; U-2 Aircraft

20030062999 NASA Langley Research Center, Hampton, VA, USA

Post-flight Analysis of the Argon Filled Ion Chamber

Tai, H.; Goldhagen, P.; Jones, I. W.; Wilson, J. W.; Maiden, D. L.; Shinn, J. L.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 187-225; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Atmospheric ionizing radiation is a complex mixture of primary galactic and solar cosmic rays and a multitude of secondary particles produced in collision with air nuclei. The first series of Atmospheric Ionizing Radiation (AIR) measurement flights on the NASA research aircraft ER-2 took place in June 1997. The ER-2 flight package consisted of fifteen instruments from six countries and were chosen to provide varying sensitivity to specific components. These AIR ER-2 flight measurements are to characterize the AIR environment during solar minimum to allow the continued development of environmental models of this complex mixture of ionizing radiation. This will enable scientists to study the ionizing radiation health hazard associated with the high-altitude operation of a commercial supersonic transport and to allow estimates of single event upsets for advanced avionics systems design. The argon filled ion chamber representing about 40 percent of the contributions to radiation risks are analyzed herein and model discrepancies for solar minimum environment are on the order of 5 percent and less. Other biologically significant components remain to be analyzed.

Derived from text

Atmospheric Radiation; Postflight Analysis; Ionizing Radiation; Argon; Ionization Chambers

20030063001 Yale Univ., New Haven, CT, USA

Cosmic Radiation Measurements with Superheated Drop Detectors

dErrico, Francesco; Apfel, Robert; Curzio, Giorgio; Nath, Ravinder; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 295-309; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The NASA-DOE AIR project took advantage of the complementary properties of a large array of radiation detection instruments to investigate the radiation field encountered on high-altitude flights. A highly sensitive extended-energy multisphere spectrometer was the primary neutron measuring device, while fourteen other radiation detectors provided additional information. Among these, active and passive devices based on superheated emulsions (superheated drop detectors and bubble damage detectors) were included for their ability to measure neutron dose equivalent while discriminating the sparsely ionizing components of the radiation field. With the assistance of the NASA Langley Research Center, Yale University and the Universit degli Studi di Pisa (Italy) developed for these measurements a compact active monitor based on superheated drop detectors. The device was especially designed to operate in the nose rack of the NASA ER-2 aircraft, at low levels of temperature and pressure. It was successfully flown on all the AIR sorties carried out in June 1997. The measurements were analyzed on the basis of extensive investigations of the superheated drop detector response to high energy neutrons. The fluence response of the detector was determined up to 134 MeV performing calibrations in quasimonoenergetic neutron beams available at various radiation metrology and research centers. The calibration factor converting number of bubbles to neutron ambient dose equivalent was determined at CERN using a reference field which reproduces the neutron spectra encountered in the stratosphere. While the count rate of the device was too for a dose rate determination, total neutron ambient dose equivalent values were determined with an estimated uncertainty of less than 30\% and agree with the values determined using etched track dosimeters and tissue equivalent proportional counters.

Derived from text

Cosmic Rays; Superheating; Aircraft Instruments; Radiation Measurement

20030063002 NASA Langley Research Center, Hampton, VA, USA

AIR Instrument Array

Jones, I. W.; Wilson, J. W.; Maiden, D. L.; Goldhagen, P.; Shinn, J. L.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 107-119; In English; See also 20030062989; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The large number of radiation types composing the atmospheric radiation requires a complicated combination of instrument types to fully characterize the environment. A completely satisfactory combination has not as yet been flown and would require a large capital outlay to develop. In that the funds of the current project were limited to essential integration costs, an international collaboration was formed with partners from six countries and fourteen different institutions with their own financial support for their participation. Instruments were chosen to cover sensitivity to all radiation types with enough differential sensitivity to separate individual components. Some instruments were chosen as important to specify the physical field component and other instruments were chosen on the basis that they could be useful in dosimetric evaluation. In the

present paper we will discuss the final experimental flight package for the ER-2 flight campaign.
Author
Atmospheric Radiation; Ionizing Radiation; Flight Instruments; Instrument Packages; U-2 Aircraft

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20030062070 Stanford Univ., Stanford, CA, USA
Compact Laser-Based Sensors for Monitoring and Control of Gas Turbine Combustors
Hanson, Ronald K.; Jeffries, Jay B.; [2003]; 19 pp.; In English
Contract(s)/Grant(s): NAG2-1478; No Copyright; Avail: CASI; A03, Hardcopy

Research is reported on the development of sensors for gas turbine combustor applications that measure real-time gas temperature using near-infrared water vapor absorption and concentration in the combustor exhaust of trace quantities of pollutant NO and CO using mid-infrared absorption. Gas temperature is extracted from the relative absorption strength of two near-infrared transitions of water vapor. From a survey of the water vapor absorption spectrum, two overtone transitions near 1800 nm were selected that can be rapidly scanned in wavelength by injection current tuning a single DFB diode laser. From the ratio of the absorbances on these selected transitions, a path-integrated gas temperature can be extracted in near-real time. Demonstration measurements with this new temperature sensor showed that combustor instabilities could be identified in the power spectrum of the temperature versus time record. These results suggest that this strategy is extremely promising for gas turbine combustor control applications. Measurements of the concentration of NO and CO in the combustor exhaust are demonstrated with mid-infrared transitions using thermo-electrically cooled, quantum cascade lasers operating near 5.26 and 4.62 microns respectively. Measurements of NO are performed in an insulated exhaust duct of a C2H4-air flame at temperatures of approximately 600 K. CO measurements are performed above a rich H2-air flame seeded with CO2 and cooled with excess N2 to 1150 K. Using a balanced ratiometric detection technique a sensitivity of 0.36 ppm-m was achieved for NO and 0.21 ppm-m for CO. Comparisons between measured and predicted water-vapor and CO2 interference are discussed. The mid-infrared laser quantum cascade laser technology is in its infancy; however, these measurements demonstrate the potential for pollutant monitoring in exhaust gases with mid-IR laser absorption.
Author
Engine Monitoring Instruments; Gas Turbine Engines; Combustion Chambers; Gas Temperature; Temperature Sensors; Pollution Monitoring; Exhaust Emission

20030062089 NASA Glenn Research Center, Cleveland, OH, USA
Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle
Kohout, Lisa L.; Schmitz, Paul C.; June 2003; 14 pp.; In English; International Air and Space Symposium and Exposition, 14-17 Jul. 2003, Dayton, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS-22-708-87-11
Report No.(s): NASA/TM-2003-212354; NAS 1.15:212354; E?13942; AIAA Paper 2003-2867; Copyright; Avail: CASI; A03, Hardcopy

There is a growing interest in the use of fuel cells as a power source for all-electric aircraft propulsion as a means to substantially reduce or eliminate environmentally harmful emissions. Among the technologies under consideration for these concepts are advanced proton exchange membrane and solid oxide fuel cells, alternative fuels and fuel processing, and fuel storage. This paper summarizes the results of a first-order feasibility study for an all-electric personal air vehicle utilizing a fuel cell-powered propulsion system. A representative aircraft with an internal combustion engine was chosen as a baseline to provide key parameters to the study, including engine power and subsystem mass, fuel storage volume and mass, and aircraft range. The engine, fuel tank, and associated ancillaries were then replaced with a fuel cell subsystem. Various configurations were considered including: a proton exchange membrane (PEM) fuel cell with liquid hydrogen storage; a direct methanol PEM fuel cell; and a direct internal reforming solid oxide fuel cell (SOFC)/turbine hybrid system using liquid

methane fuel. Each configuration was compared to the baseline case on a mass and range basis.
Author
Fuel Cells; Propulsion System Performance; Aircraft Engines; Solid Oxide Fuel Cells; Turbines; Propulsion System Configurations

20030062196 NASA Glenn Research Center, Cleveland, OH, USA
Low Emissions RQL Flametube Combustor Test Results
Chang, Clarence T.; Holdeman, James D.; July 2001; 50 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WU 714-01-40
Report No.(s): NASA/TM-2001-211107; E-12954; NAS 1.15:211107; No Copyright; Avail: CASI; A03, Hardcopy

The overall objective of this test program was to demonstrate and evaluate the capability of the Rich-burn/Quick-mix/Lean-burn (RQL) combustor concept for HSR applications. This test program was in support of the Pratt & Whitney and GE Aircraft Engines HSR low-NOx Combustor Program. Collaborative programs with Parker Hannifin Corporation and Textron Fuel Systems resulted in the development and testing of the high-flow low-NOx rich-burn zone fuel-to-air ratio research fuel nozzles used in this test program. Based on the results obtained in this test program, several conclusions can be made: (1) The RQL tests gave low NOx and CO emissions results at conditions corresponding to HSR cruise. (2) The Textron fuel nozzle design with optimal multiple partitioning of fuel and air circuits shows potential of providing an acceptable uniform local fuel-rich region in the rich burner. (3) For the parameters studied in this test series, the tests have shown T3 is the dominant factor in the NOx formation for RQL combustors. As T3 increases from 600 to 1100 F, EI(NOx) increases approximately three fold. (4) Factors which appear to have secondary influence on NOx formation are P4, T4, infinity(sub rb), V(sub ref,ov). (5) Low smoke numbers were measured for infinity(sub rb) of 2.0 at P4 of 120 psia.
Author
Combustion Chambers; Gas Turbine Engines; Nozzle Design; Performance Tests; Combustion Efficiency; Exhaust Emission; Exhaust Gases

20030062755 Army Aviation and Missile Command, Moffett Field, CA, USA
Power Measurement Errors on a Utility Aircraft
Bousman, William G.; [2001]; 4 pp.; In English; American Helicopter Society Aerodynamics, Acoustics and Test and Evaluation Technical Specialist Meeting, 23-25 Jan. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Power measurements were made on a highly-instrumented UH-60A in 1993 and 1994 at Ames Research Center as a part of the NASA/Amy Airloads Program. These measurements include level flight airspeed sweeps at pressure altitudes from 2,500 feet to 17,100 feet. The power measurements were based on the torque measured on both engines, the main rotor torque, and the tail rotor torque. The only unmeasured power was for the aircraft accessory drive, nominally about 65 HP. Using a power balance equation, these measurements were examined, and it was determined that the unmeasured power varied from approximately -40 to 175 HP. Assuming the accessory drive power was constant at 65 HP, then this indicates that errors occurred in these power measurements, ranging from -105 to 110 HP. New rotor blades for the UH-60 fleet, referred to as the Growth Rotor Blades (GRB), have been developed in the last decade. These blades were tested on an UH-60L aircraft with the -701C engines from March to November 1999. The testing was performed by a combined Sikorsky/Army test team at West Palm Beach, FL, and Alamosa, CO. Both hover and forward flight test data were obtained. As with the UH-60A Airloads Program, power measurements were based on the torque measured on both engines, the main rotor torque, and the tail rotor torque. An analysis of the power balance equation shows that the unmeasured power varied from -35 to 245 HP. Again, assuming an accessory power of 65 HP, this indicates measurement errors ranging from -100 to 180 HP. The proposed paper will examine these power measurement errors and discuss possible causes. For example, the power loss data (unmeasured power) for individual test points as a function of the outside air temperature (OAT). For the Airloads data, OAT, as an independent variable explains about 80\% of the variance, using a linear fit. For the GRB data, the effect of OAT is best represented by a quadratic expression, and less of the variance is a consequence of OAT. It will be shown in the full paper that there are other sources of measurement errors in these two tests than the temperature effects shown in these figures. It will be demonstrated that it is not possible at this time to identify the probable cause of these errors. Measurement errors in either the engine torque meters, the main rotor shaft, or both can explain these errors, and improvements in these measurements will require independent experimentation to isolate the causes.
Author
Airspeed; Torque; Tail Rotors; Aerodynamic Loads; Flight Tests

20030062782 Boeing Space and Communications Seal Beach CA, Seal Beach, CA, USA
Boeing to Test Oxidizer Pump for Advanced Rocket Engine
Beck, Dan; Beach, Ann; Mar. 5, 2003; 5 pp.; In English
Contract(s)/Grant(s): F04611-02-2-0003; Proj-4922
Report No.(s): AD-A412349; AFRL-PR-ED-PR-2003-058; No Copyright; Avail: CASI; A01, Hardcopy

On the heels of a successful series of preburner tests for the Air Force Research laboratory's integrated Powerhead Demonstration (IPD) at the Stennis Space Center (SSC) in Mississippi, the Rocketdyne Propulsion and Power (RPP) business of the Boeing Company will next turn its attention to hot fire testing of its oxidizer turbopump which will become part of the IPD engine system and provide key technologies for the RS-84 engine which is part of NASA's Space Launch Initiative. DTIC

Oxidizers; Rocket Engines; Spacecraft Launching; Combustion; Turbine Pumps

20030062917 Rotary Power International, Inc., Wood-Ridge, NJ, USA
Advanced Propulsion Systems Study for General Aviation Aircraft
Mount, R.; July 2003; 176 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-27642; WU-538-07-10
Report No.(s): NASA/CR-2003-212334; NAS 1.26:212334; E-13929; No Copyright; Avail: CASI; A09, Hardcopy

This study defines a family of advanced technology Stratified Charge Rotary Engines (SCRE) appropriate for the enablement of the development of a new generation of general aviation aircraft. High commonality, affordability, and environmental compatibility are considerations influencing the family composition and ratings. The SCRE family is comprised of three engines in the 70 Series (40 cu in. displacement per rotor), i.e. one, two, and four rotor and two engines in the 170 Series (105 cu in. displacement per rotor), i.e., two and four rotor. The two rotor engines are considered the primary engines in each series. A wide power range is considered covering 125 to 2500 HP through growth and compounding/dual pac considerations. Mission requirements, TBO, FAA Certification, engine development cycles, and costs are examined. Comparisons to current and projected reciprocating and turbine engine configurations in the 125 to 1000 HP class are provided. Market impact, estimated sales, and U.S. job creation (R&D, manufacturing and infractures) are examined.
Author

Rotary Engines; Propulsion System Configurations; General Aviation Aircraft; Propulsion System Performance; Engine Design

20030063012 NASA Lewis Research Center, Cleveland, OH, USA
Numerical Simulation of Flow in a Whirling Annular Seal and Comparison With Experiments
Athavale, M. M.; Hendricks, R. C.; Steinetz, B. M.; March 1996; 16 pp.; In English; Sixth International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 25-29 Feb. 1996, Honolulu, HI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-25644; WU 242-20-06
Report No.(s): NASA-TM-107117; E-10026; NAS 1.15:107117; No Copyright; Avail: CASI; A03, Hardcopy

The turbulent flow field inside a whirling annular seal was simulated by using SCISEAL, a three-dimensional computational fluid dynamics code. The rotor center described a circular synchronous whirl. A rotating frame transformation was used to make the problem quasi-steady. The flow field at an axial Reynolds number of 24,000 and a Taylor number of 6600 was simulated. The standard kappa-epsilon model with wall functions and the low-Reynolds-number model were used to treat turbulence. An experimentally measured velocity field was used at the inlet boundary. Numerical predictions of the velocities and the stator wall pressures compared well with experimental data. Both turbulence models yielded nearly the same results. The capability of the SCISEAL code to analyze this complex flow field was demonstrated; the isotropic turbulence models performed adequately on this nonisotropic turbulence flow.
Author

Turbulent Flow; Computational Fluid Dynamics; Flow Distribution; K-Epsilon Turbulence Model; Numerical Analysis

20030063053 Pratt and Whitney Aircraft, East Hartford, CT, USA
Enhanced Mixing in a Rectangular Duct
Liscinsky, D. S.; True, B.; June 2003; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-25954; WBS 22-714-01-38
Report No.(s): NASA/CR-2003-212320; NAS 1.26:212320; E-13907; No Copyright; Avail: CASI; A04, Hardcopy

An experimental investigation of the mixing of non-reacting opposed rows of jets injected normal to a confined rectangular crossflow has been conducted. Planar Mie-scattering was used to measure the time-average concentration distribution of the jet fluid in planes perpendicular to the duct axis. Particular emphasis was placed on the study of closely spaced orifice configurations applicable to the mixing zone of an RQL combustor. Baseline studies were performed of mixing under 'ideal' conditions, i.e., plenum fed jets injecting into a crossflow uniform in velocity and turbulence intensity. In addition, more practical ('non-ideal') issues encountered during hardware design were also studied. As in other studies, mixing effectiveness, determined using a spatial unmixedness parameter based on the variance of mean jet concentration distributions, was found to be optimum when the spacing-to-duct-height ratio was inversely proportional to the square root of the jet-to-mainstream momentum-flux ratio. This relationship is suitable for design under ideal flow conditions. Inlet flow boundary conditions of the jet and approach flow (mainstream) were found to strongly influence mixing performance, but no attempt was made to determine optimum performance under non-ideal conditions. The tests performed do offer some guidance as to expected mixing behavior for several common variables likely to be imposed by hardware constraints. Additionally, in this study it was found that for rows of orifices with opposite centerlines inline, mixing was similar for blockages up to 89 percent (previous crossflow mixing studies concerned with dilution zone configurations, blockages were typically less than 50 percent). Lower levels of unmixedness were obtained as a function of downstream location when axial injection length was minimized. Mixing may be enhanced if orifice centerlines of opposed rows are staggered, but blockage must be =50 percent in this configuration. Round hole and 'square' orifice shapes had similar performance. Other variations in orifice shape did not substantially augment overall mixing performance. Furthermore an isothermal mixing data set was generated and used by CFDRC as input to a NO(x) inference code.
Author
Gas Turbines; Mie Scattering; Injection; Inlet Flow; Jet Flow; Velocity Distribution

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20030062109 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Integrated Approach to the Dynamics and Control of Maneuvering Flexible Aircraft
Waszak, Martin R., Technical Monitor; Meirovitch, Leonard; Tuzcu, Ilhan; July 2003; 76 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC1-346; 706-31-41-02
Report No.(s): NASA/CR-2003-211748; NAS 1.26:211748; No Copyright; Avail: CASI; A05, Hardcopy

This work uses a fundamental approach to the problem of simulating the flight of flexible aircraft. To this end, it integrates into a single formulation the pertinent disciplines, namely, analytical dynamics, structural dynamics, aerodynamics, and controls. It considers both the rigid body motions of the aircraft, three translations (forward motion, sideslip and plunge) and three rotations (roll, pitch and yaw), and the elastic deformations of every point of the aircraft, as well as the aerodynamic, propulsion, gravity and control forces. The equations of motion are expressed in a form ideally suited for computer processing. A perturbation approach yields a flight dynamics problem for the motions of a quasi-rigid aircraft and an 'extended aeroelasticity' problem for the elastic deformations and perturbations in the rigid body motions, with the solution of the first problem entering as an input into the second problem. The control forces for the flight dynamics problem are obtained by an 'inverse' process and the feedback controls for the extended aeroservoelasticity problem are determined by the LQG theory. A numerical example presents time simulations of rigid body perturbations and elastic deformations about 1) a steady level flight and 2) a level steady turn maneuver.
Author
Aeroservoelasticity; Aerodynamics; Flexible Wings; Aircraft Maneuvers; Flight Simulation; Aircraft Control

20030062777 Wright State Univ., Dayton, OH, USA
Designing Human-Machine Interfaces Using Principles of Stochastic Resonance
Repperger, Daniel W.; Phillips, C. A.; Berlin, James E.; Neidhard, A.; Haas, Michael W.; Apr. 2001; 50 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A412330; AFRL-HE-WP-TR-2002-0187; No Copyright; Avail: CASI; A03, Hardcopy

An experimental study is described which involves two types of haptic sensory information and its impact on the ability

of the human operator to perform a target tracking task. A principal termed, 'stochastic resonance was applied to design the haptic interface to enhance the operator's sense of presence. In essence, the way that stochastic resonance works, is to provide a sufficiently small amount of noise into a nonlinear system in such a way that the overall system is stimulated, but not degraded in performance. Too little noise or too much noise input is not beneficial to the operator. A small amount of noise, however, presented in judicious manner can be shown to stimulate the process but not to degrade its efficacy. In this study, haptic (force reflecting joystick) inputs were provided to the operator through his hand as well as haptic (motion chair) inputs as derived by a motion chair in the Human Sensory Feedback Laboratory. The results (across seven subjects) clearly demonstrated that an optimum amount of noise from the haptic joystick and motion chair combination could improve the ability of the operator to track signals and provide higher signal to noise ratios in his response.
DTIC
Man Machine Systems; Stochastic Processes

20030062988 NASA Langley Research Center, Hampton, VA, USA
Active Control of F/A-18 Vertical Tail Buffeting using Piezoelectric Actuators
Sheta, Essam F.; Moses, Robert W.; Huttsell, Lawerence J.; Harrand, Vincent J.; [2003]; 12 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics & Materials Conference, 16-19 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1887; No Copyright; Avail: CASI; A03, Hardcopy

Vertical tail buffeting is a serious multidisciplinary problem that limits the performance of twin-tail fighter aircraft. The buffet problem occurs at high angles of attack when the vortical flow breaks down ahead of the vertical tails resulting in unsteady and unbalanced pressure loads on the vertical tails. This paper describes a multidisciplinary computational investigation for buffet load alleviation of full F/A-18 aircraft using distributed piezoelectric actuators. The inboard and outboard surfaces of the vertical tail are equipped with piezoelectric actuators to control the buffet responses in the first bending and torsion modes. The electrodynamics of the smart structure are expressed with a three-dimensional finite element model. A single-input-single-output controller is designed to drive the active piezoelectric actuators. High-fidelity multidisciplinary analysis modules for the fluid dynamics, structure dynamics, electrodynamics of the piezoelectric actuators, fluid-structure interfacing, and grid motion are integrated into a multidisciplinary computing environment that controls the temporal synchronization of the analysis modules. Peak values of the power spectral density of tail tip acceleration are reduced by as much as 22\% in the first bending mode and by as much as 82\% in the first torsion mode. RMS values of tip acceleration are reduced by as much as 12\%.
Author
Tail Assemblies; F-18 Aircraft; Active Control; Buffeting; Stabilizers (Fluid Dynamics); Piezoelectric Actuators

20030063163 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
Comparison of Wind-Tunnel Predictions with Flight Measurements of the Longitudinal-Stability and -Control Characteristics of a Douglas BTD-1 Airplane
Bunnell, Mort V.; Delany, Noel K.; February 13, 1947; 43 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A6L30; No Copyright; Avail: CASI; A03, Hardcopy

Low Mach number longitudinal-stability and control characteristics as predicted by use of wind tunnel data from a powered 3/16-scale model are compared with flight test measurements of a Navy BTD-1 airplane. The accuracy of the wind tunnel data and the discrepancies involved in attempting to correlate with flight data are discussed and analyzed. The comparison showed that wind tunnel predictions were, in general, in good agreement with flight test data. The predicted values were for the most part sufficiently accurate to show the satisfactory and unsatisfactory characteristics in the preliminary design stage and to indicate possible methods of improvement. The discrepancies which did occur were attributed principally to physical dissimilarities between model and airplane and the instability to determine accurately the flight power conditions. The effect of Mach number was considered negligible since the maximum flight test value was about 0.5. In order to simulate more closely the flight conditions and hence obtain more accurate data for predictions, it appears desirable to perform large-scale tests of unorthodox control surfaces such as the sealed vaned elevators with which the airplane was equipped.
Author
Flight Tests; Longitudinal Stability; Wind Tunnel Tests; Douglas Aircraft; Flight Characteristics; Longitudinal Control

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20030062965 North Carolina Agricultural and Technical State Univ., Greensboro, NC
North Carolina Agricultural and Technical State University Jet Propulsion Laboratory
Ferguson, Frederick; Schulz, Mark; Sundaresan, Mannur; Feb. 5, 2003; 29 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0251; Proj-3484
Report No.(s): AD-A411508; AFRL-SR-AR-TR-03-0026; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
DTIC
Research Facilities; Aerospace Systems

20030063068 North Dakota State Univ., Fargo, ND, USA
Airport Pavement Management
Varma, Amiy; Ollerman, Franz; Haag, Thomas; Suleiman, Nabil; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-22; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

Airport pavements are extensive and constitute significant infrastructure supporting air transportation. With considerable growth in air transportation, preserving, improving, and expanding airport infrastructure, including pavements, have become more important and necessary. Thus, there is emphasis on Airport Pavement Management System (APMS). APMS have evolved from a concept to a coordinated, integrated, responsive, and implementable system. The development of technologies such as CAD, GIs, GPS, remote sensing, and multimedia tools have potential to considerably improve APMS. The paper first discusses the concept and need for APMS and various pieces of Airport Pavement Management Information (APMI). The paper next examines the differing characteristics and needs for APMS at commercial airports and general aviation airports. Finally, the paper discusses the emerging issues related to airport pavement management and the opportunities that exist in developing adequate, reliable and appropriate APMI and in making APMS integrated and responsive using emerging technologies and system methodologies.
Author
Airports; Commercial Aircraft; Pavements; Flight Management Systems

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20030062937 Air Force Research Lab., Edwards AFB, CA, USA
Pulse Combustion Rockets for Space Propulsion Applications
Coy, Edward B.; Talley, Douglas G.; Watts, Jonathan M.; May 10, 2002; 3 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A410983; AFRL-PR-ED-AB-2002-109; No Copyright; Avail: CASI; A01, Hardcopy

Pulse combustion propulsion devices are currently being considered as alternatives to conventional constant-pressure engines. Potential advantages include reduction or elimination of pumps and/or compressors, and improved Isp for a given feed system supply pressure. In this paper the authors compare pulse combustors, or constant-volume engines, with pulse detonation engines and discuss why in some applications the former may be the preferred cycle. A model is presented for a monopropellant-fueled, constant-volume, pulse combustor which includes finite-rate processes for injection, heat release, and exhaust. The model is used to explore the time and dimensional scales of the device and to predict performance and optimal geometry. The pulsed propulsion device is found to have nearly identical specific impulse as the steady-state engine operating with the same mass flow and throat area, and the nozzle optimizes at the same area ratio. Pulsed combustor behavior is found to depend on two time scales: the ratio of the heat release time to the chamber blowdown time, and the ratio of the blowdown

time to the injector pulsing period. The authors briefly consider the application of pulse combustion devices in pressure-fed satellite propulsion systems and examine their effect on satellite mission.
DTIC
Pulse Detonation Engines; Technology Utilization; Rocket Engines; Spacecraft Propulsion

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20030062166 NASA Marshall Space Flight Center, Huntsville, AL, USA
Review of the High Performance Antiproton Trap (HiPAT) Experiment at the Marshall Space Flight Center
Pearson, J. B.; Sims, Herb; Martin, James; Chakrabarti, Suman; Lewis, Raymond; Fant, Wallace; [2003]; 25 pp.; In English; Advanced Space Propulsion Workshop, 15-17 Apr. 2003, Huntsville, AL, USA; Copyright; Avail: CASI; A03, Hardcopy

The significant energy density of matter-antimatter annihilation is attractive to the designers of future space propulsion systems, with the potential to offer a highly compact source of power. Many propulsion concepts exist that could take advantage of matter-antimatter reactions, and current antiproton production rates are sufficient to support basic proof-of-principle evaluation of technology associated with antimatter- derived propulsion. One enabling technology for such experiments is portable storage of low energy antiprotons, allowing antiprotons to be trapped, stored, and transported for use at an experimental facility. To address this need, the Marshall Space Flight Center's Propulsion Research Center is developing a storage system referred to as the High Performance Antiproton Trap (HiPAT) with a design goal of containing 10(exp 12) particles for up to 18 days. The HiPAT makes use of an electromagnetic system (Penning- Malmberg design) consisting of a 4 Telsa superconductor, high voltage electrode structure, radio frequency (RF) network, and ultra high vacuum system. To evaluate the system normal matter sources (both electron guns and ion sources) are used to generate charged particles. The electron beams ionize gas within the trapping region producing ions in situ, whereas the ion sources produce the particles external to the trapping region and required dynamic capture. A wide range of experiments has been performed examining factors such as ion storage lifetimes, effect of RF energy on storage lifetime, and ability to routinely perform dynamic ion capture. Current efforts have been focused on improving the FW rotating wall system to permit longer storage times and non-destructive diagnostics of stored ions. Typical particle detection is performed by extracting trapped ions from HiPAT and destructively colliding them with a micro-channel plate detector (providing number and energy information). This improved RF system has been used to detect various plasma modes for both electron and ion plasmas in the two traps at MSFC, including axial, cyclotron, and diocotron modes. New diagnostics are also being added to HiPAT to measure the axial density distribution of the trapped cloud to match measured RF plasma modes to plasma conditions.
Author
Antiprotons; Energy Storage; Traps; Trapped Particles; Superconductors (Materials); Systems Engineering; Vacuum Systems

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20030062157 NASA Marshall Space Flight Center, Huntsville, AL, USA
International Cooperation of Payload Operations on the International Space Station
Melton, Tina; Onken, Jay; [2003]; 2 pp.; In English; AIAA/ICAS International Air and Space Symposium, 14-17 Jul. 2003, Dayton, OH, USA; No Copyright; Avail: CASI; A01, Hardcopy

One of the primary goals of the International Space Station (ISS) is to provide an orbiting laboratory to be used to conduct scientific research and commercial products utilizing the unique environment of space. The ISS Program has united multiple nations into a coalition with the objective of developing and outfitting this orbiting laboratory and sharing in the utilization of the resources available. The primary objectives of the real- time integration of ISS payload operations are to ensure safe operations of payloads, to avoid mutual interference between payloads and onboard systems, to monitor the use of integrated station resources and to increase the total effectiveness of ISS. The ISS organizational architecture has provided for the

distribution of operations planning and execution functions to the organizations with expertise to perform each function. Each IPP is responsible for the integration and operations of their payloads within their resource allocations and the safety requirements defined by the joint program. Another area of international cooperation is the sharing in the development and on- orbit utilization of unique payload facilities. An example of this cooperation is the Microgravity Science Glovebox. The hardware was developed by ESA and provided to NASA as part of a barter arrangement.
Author
International Cooperation; Payloads; International Space Station; Real Time Operation; Microgravity

20030062816 Kansas State Univ., KS, USA
Useful Life Prediction for Payload Carrier Hardware
Ben-Arieh, David; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 11-20; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Space Shuttle has been identified for use through 2020. Payload carrier systems will be needed to support missions through the same time frame. To support the future decision making process with reliable systems, it is necessary to analyze design integrity, identify possible sources of undesirable risk and recognize required upgrades for carrier systems. This project analyzed the information available regarding the carriers and developed the probability of becoming obsolete under different scenarios. In addition, this project resulted in a plan for an improved information system that will improve monitoring and control of the various carriers. The information collected throughout this project is presented in this report as process flow, historical records, and statistical analysis.
Author
Space Shuttles; Service Life; Predictions; Payloads

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20030062082 NASA Marshall Space Flight Center, Huntsville, AL, USA
Utilization of Internet Protocol-Based Voice Systems in Remote Payload Operations
Best, Susan; Nichols, Kelvin; Bradford, Robert; [2003]; 21 pp.; In English; Ground Systems Architectures Workshop, 4-6 Mar. 2003, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides an overview of a proposed voice communication system for use in remote payload operations performed on the International Space Station. The system, Internet Voice Distribution System (IVoDS), would make use of existing Internet protocols, and offer a number of advantages over the system currently in use. Topics covered include: system description and operation, system software and hardware, system architecture, project status, and technology transfer applications.
Author
Wireless Communication; Voice Communication; Voice Control; Space Shuttle Payloads; Remote Control; Communication Networks; Spacecraft Communication

20030062898 NASA Ames Research Center, Moffett Field, CA, USA
Scheduling Earth Observing Satellites with Evolutionary Algorithms
Globus, Al; Crawford, James; Lohn, Jason; Pryor, Anna; [2003]; 7 pp.; In English; International Conference on Space Mission Challenges for Information Technology, Jul. 2003, Pasadena, CA, USA
Contract(s)/Grant(s): AIST-0042; No Copyright; Avail: CASI; A02, Hardcopy

We hypothesize that evolutionary algorithms can effectively schedule coordinated fleets of Earth observing satellites. The constraints are complex and the bottlenecks are not well understood, a condition where evolutionary algorithms are often effective. This is, in part, because evolutionary algorithms require only that one can represent solutions, modify solutions, and evaluate solution fitness. To test the hypothesis we have developed a representative set of problems, produced optimization software (in Java) to solve them, and run experiments comparing techniques. This paper presents initial results of a comparison of several evolutionary and other optimization techniques; namely the genetic algorithm, simulated annealing, squeaky wheel optimization, and stochastic hill climbing. We also compare separate satellite vs. integrated scheduling of a two satellite

constellation. While the results are not definitive, tests to date suggest that simulated annealing is the best search technique and integrated scheduling is superior.
Author
Algorithms; Genetic Algorithms; Earth Observing System (Eos); Satellite Constellations

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20030062017 NASA Marshall Space Flight Center, Huntsville, AL, USA
Pathways to Colonization
Smitherman, David V., Jr.; [2003]; 7 pp.; In English; Space Technology and Applications International Forum, 2-6 Feb. 2003, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy

The steps required for space colonization are many to grow from our current 3-person International Space Station, now under construction, to an infrastructure that can support hundreds and eventually thousands of people in space. This paper will summarize the author's findings from numerous studies and workshops on related subjects and identify some of the critical next steps toward space colonization. Findings will be drawn from the author s previous work on space colony design, space infrastructure workshops, and various studies that addressed space policy. In conclusion, this paper will note that significant progress has been made on space facility construction through the International Space Station program, and that significant efforts are needed in the development of new reusable Earth to Orbit transportation systems. The next key steps will include reusable in space transportation systems supported by in space propellant depots, the continued development of inflatable habitat and space elevator technologies, and the resolution of policy issues that will establish a future vision for space development.
Author
Space Colonies; Space Transportation System; International Space Station; Aerospace Engineering; Habitats

20030062031 NASA Marshall Space Flight Center, Huntsville, AL, USA
Overview of NASA's Space Environments and Effects (SEE) Program Technology Development Activities
Kauffman, Billy; Hardage, Donna; Minor, Jody; March 25, 2003; 1 pp.; In English; Effects of Space Weather on Technology Infrastructure NATO Advanced Research Workshop, Mar. 2003, Rhodes, Greece; No Copyright; Avail: Other Sources; Abstract Only

Reducing size and weight of spacecraft, along with demanding increased performance capabilities, introduces many uncertainties in the engineering design community on how spacecraft and spacecraft systems will perform in space. The engineering design community is forever behind on obtaining and developing new tools and guidelines to mitigate the harmful effects of the space environment. Adding to this complexity is the push to use Commercial-off-the-shelf (COTS) and shrinking microelectronics behind less shielding utilizing new materials. The potential usage of unproven technologies such as large solar sail structures and nuclear electric propulsion introduces new requirements to develop new engineering tools. In order to drive down these uncertainties, NASA s SEE Program provides resources for technology development to accommodate or mitigate these harmful environments on spacecraft. This paper will describe the current SEE Program's, currently funded activities and possible future developments.
Author
Aerospace Environments; Commercial Off-The-Shelf Products; Spacecraft Design; Spacecraft Performance; Weight Reduction; Microelectronics

20030062062 NASA Marshall Space Flight Center, Huntsville, AL, USA
First Post-Flight Status Report for the Microgravity Science Glovebox
Baugher, Charles R., III; [2003]; 1 pp.; In English; American Inst. of Aeronautics and Astronautics Conference, 5-10 Jan. 2003, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

The Microgravity Science Glovebox (MSG) was launched to the International Space Station (ISS) this year on the second Utilization Flight (UF2). After successful on-orbit activation, the facility began supporting an active microgravity research

program. The inaugural NASA experiments operated in the unit were the Solidification Using a Baffle in Sealed Ampoules (SUBSA, A. Ostrogorski, PI), and the Pore Formation and Mobility (PFMI, R. Grugel, PI) experiments. Both of these materials science investigations demonstrated the versatility of the facility through extensive use of telescience. The facility afforded the investigators with the capability of monitoring and operating the experiments in real-time and provided several instances in which the unique combination of scientists and flight crew were able to salvage situations which would have otherwise led to the loss of a science experiment in an unmanned, or automated, environment. The European Space Agency (ESA) also made use of the facility to perform a series of four experiments that were carried to the ISS via a Russian Soyuz and subsequently operated by a Belgium astronaut during a ten day Station visit. This imaginative approach demonstrated the ability of the MSG integration team to handle a rapid integration schedule (approximately seven months) and an intensive operations interval. Interestingly, and thanks to aggressive attention from the crew, the primary limitation to experiment thru-put in these early operational phases is proving to be the restrictions on the up-mass to the Station, rather than the availability of science operations.
Author
International Space Station; Spaceborne Experiments; Postflight Analysis; Microgravity; Space Shuttle Payloads

20030062068 NASA Marshall Space Flight Center, Huntsville, AL, USA
Design Features and Capabilities of the First Materials Science Research Rack
Pettigrew, P. J.; Lehoczky, S. L.; Cobb, S. D.; Holloway, T.; Kitchens, L.; [2003]; 1 pp.; In English; 2003 Institute of Electrical and Electronic Engineering Aerospace Conference, 8-15 Jul. 2003, Big Sky, MT, USA; No Copyright; Avail: Other Sources; Abstract Only

The First Materials Science Research Rack (MSRR-1) aboard the International Space Station (ISS) will offer many unique capabilities and design features to facilitate a wide range of materials science investigations. The initial configuration of MSRR-1 will accommodate two independent Experiment Modules (EMS) and provide the capability for simultaneous on-orbit processing. The facility will provide the common subsystems and interfaces required for the operation of experiment hardware and accommodate telescience capabilities. MSRR1 will utilize an International Standard Payload Rack (ISPR) equipped with an Active Rack Isolation System (ARIS) for vibration isolation of the facility.
Author
International Space Station; Spaceborne Experiments; Space Laboratories; Design Analysis; Design Optimization

20030062086 NASA Marshall Space Flight Center, Huntsville, AL, USA
Changes in the Optical Properties of Simulated Shuttle Waste Water Deposits: Urine Darkening
Albyn, Keith; Edwards, David; Alred, John; [2003]; 30 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Manned spacecraft have historically dumped the crew generated waste water overboard, into the environment in which the spacecraft operates, sometimes depositing the waste water on the external spacecraft surfaces. The change in optical properties of wastewater deposited on spacecraft external surfaces, from exposure to space environmental effects, is not well understood. This study used nonvolatile residue (NVR) from Human Urine to simulate wastewater deposits and documents the changes in the optical properties of the NVR deposits after exposure to ultra violet(UV)radiation. Twenty four NVR samples of, 0-angstromes/sq cm to 1000-angstromes/sq cm, and one sample contaminated with 1 to 2-mg/sq cm were exposed to UV radiation over the course of approximately 6151 equivalent sun hours (ESH). Random changes in sample mass, NVR, solar absorbance, and infrared emission were observed during the study. Significant changes in the UV transmittance were observed for one sample contaminated at the mg/sq cm level.
Author
Waste Water; Manned Spacecraft; Environment Effects; Infrared Radiation; Aerospace Environments; Contamination

20030062111 NASA Marshall Space Flight Center, Huntsville, AL, USA
Tethers as Debris: Hydrocode Simulation of Impacts of Polymer Tether Fragments on Aluminum Plates
Evans, Steven W.; February 18, 2003; 6 pp.; In English
Contract(s)/Grant(s): 279-02-14; No Copyright; Avail: CASI; A02, Hardcopy

Tethers promise to find use in a variety of space applications. Despite being narrow objects, their great lengths result in them having large total areas. Consequently, tethers are very susceptible to being severed by orbital debris. Extensive work has been done designing tethers that resist severs by small debris objects, in order to lengthen their working lives. It is from this perspective that most recent work has considered the tether - debris question. The potential of intact tethers, or severed tether fragments, as debris, to pose a significant collision risk to other spacecraft has been less well studied. Understanding

the consequences of such collisions is important in assessing the risks tethers pose to other spacecraft. This paper discusses the damage that polymer tethers may produce on aluminum plates, as revealed by hypervelocity impact simulations using the SPHC hydrodynamic code.
Author
Tethering; Fragments; Hypervelocity Impact; Metal Plates; Space Debris

20030062121 NASA Marshall Space Flight Center, Huntsville, AL, USA
Crewed Mission to Callisto Using Advanced Plasma Propulsion Systems
Adams, R. B.; Statham, G.; White, S.; Patton, B.; Thio, Y. C. F.; Santarius, J.; Alexander, R.; Fincher, S.; Polsgrove, T.; Chapman, J., et al.; [2003]; 26 pp.; In English; STAIF-2003, 2-6 Feb. 2003, Albuquerque, NM, USA
Contract(s)/Grant(s): RTOP 713-50-10; Copyright; Avail: CASI; A03, Hardcopy

This paper describes the engineering of several vehicles designed for a crewed mission to the Jovian satellite Callisto. Each subsystem is discussed in detail. Mission and trajectory analysis for each mission concept is described. Crew support components are also described. Vehicles were developed using both fission powered magneto plasma dynamic (MPD) thrusters and magnetized target fusion (MTF) propulsion systems. Conclusions were drawn regarding the usefulness of these propulsion systems for crewed exploration of the outer solar system.
Author
Spacecraft Propulsion; Fusion Propulsion; Systems Engineering; Spacecraft Design; Magnetoplasmadynamic Thrusters; Plasma Propulsion; Design Analysis; Trajectory Analysis

20030062122 United Space Alliance, Cape Canaveral, FL, USA
The Use of Ion Vapor Deposited Aluminum (IVD) for the Space Shuttle Solid Rocket Booster (SRB)
Novak, Howard L.; January 2003; 19 pp.; In English; 13th Annual International Workshop on Solvent Substitution and Elimination of Toxic Substances and Emissions, 9-12 Dec. 2003, Scottsdale, AZ, USA
Contract(s)/Grant(s): NAS8-2000; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation provides an overview of the use of ion vapor deposited aluminum (IVD) for use in the Space Shuttle Solid Rocket Booster (SRB). Topics considered include: schematics of ion vapor deposition system, production of ion vapor deposition system, IVD vs. cadmium coated drogue ratchets, corrosion exposure facilities and tests, seawater immersion facilities and tests and continued research and development issues.
CASI
Vapor Deposition; Protective Coatings; Space Shuttle Boosters; Aluminum; Destructive Tests; Fatigue (Materials); Materials Selection; Spacecraft Construction Materials

20030062135 NASA Marshall Space Flight Center, Huntsville, AL, USA
EXPRESS Rack: The Extension of International Space Station Resources for Multi-Discipline Subrack Payloads
Sledd, Annette; Danford, Mike; Key, Brian; [2002]; 7 pp.; In English; IEEE Aerospace Conference, 7-15 Mar. 2003, Big Sky, MT, USA; No Copyright; Avail: CASI; A02, Hardcopy

The EXpedite the PRocessing of Experiments to Space Station or EXPRESS Rack System was developed to provide Space Station accommodations for subrack payloads. The EXPRESS Rack accepts Space Shuttle middeck locker type payloads and International Subrack Interface Standard (ISIS) Drawer payloads, allowing previously flown payloads an opportunity to transition to the International Space Station. The EXPRESS Rack provides power, data command and control, video, water cooling, air cooling, vacuum exhaust, and Nitrogen supply to payloads. The EXPRESS Rack system also includes transportation racks to transport payloads to and from the Space Station, Suitcase Simulators to allow a payload developer to verify data interfaces at the development site, Functional Checkout Units to allow payload checkout at KSC prior to launch, and trainer racks for the astronauts to learn how to operate the EXPRESS Racks prior to flight. Standard hardware and software interfaces provided by the EXPRESS Rack simplify the integration processes, and facilitate simpler ISS payload development. Whereas most ISS Payload facilities are designed to accommodate one specific type of science, the EXPRESS Rack is designed to accommodate multi-discipline research within the same rack allowing for the independent operation of each subrack payload. On-orbit operations began with the EXPRESS Rack Project on April 24, 2001, with one rack operating continuously to support long-running payloads. The other on-orbit EXPRESS Racks operate based on payload need and resource availability. Sustaining Engineering and Logistics and Maintenance functions are in place to maintain operations and to provide software upgrades.
Author
Payloads; Space Shuttle Payloads; Computer Programs; International Space Station; Command And Control

20030062183 Orbital Sciences Corp., Dulles, VA, USA

Demonstration of Autonomous Rendezvous Technology (DART) Project Summary

Rumford, TImothy E.; April 24, 2003; 10 pp.; In English; SPIE's Space Systems Technology and Operations Conference, 24 apr. 2003, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

Since the 1960's, NASA has performed numerous rendezvous and docking missions. The common element of all US rendezvous and docking is that the spacecraft has always been piloted by astronauts. Only the Russian Space Program has developed and demonstrated an autonomous capability. The Demonstration of Autonomous Rendezvous Technology (DART) project currently funded under NASA's Space Launch Initiative (SLI) Cycle I, provides a key step in establishing an autonomous rendezvous capability for the USA. DART's objective is to demonstrate, in space, the hardware and software necessary for autonomous rendezvous. Orbital Sciences Corporation intends to integrate an Advanced Video Guidance Sensor and Autonomous Rendezvous and Proximity Operations algorithms into a Pegasus upper stage in order to demonstrate the capability to autonomously rendezvous with a target currently in orbit. The DART mission will occur in April 2004. The launch site will be Vandenburg AFB and the launch vehicle will be a Pegasus XL equipped with a Hydrazine Auxiliary Propulsion System 4th stage. All mission objectives will be completed within a 24 hour period. The paper provides a summary of mission objectives, mission overview and a discussion on the design features of the chase and target vehicles.

Author

Spacecraft Docking; Orbital Rendezvous; Unmanned Spacecraft; Guidance Sensors; Optical Measuring Instruments; Design Analysis; Autonomous Navigation

20030062194 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development Of A Novel Discontinuously-Reinforced Aluminum For Space Applications

Pandey, A. B.; Shah, S.; Shadoan, M.; [2002]; 1 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA; No Copyright; Avail: Other Sources; Abstract Only

Discontinuously-reinforced aluminum (DRA) has been used in aerospace structures such as Ventral Fins and Fan Exit Guide Vanes owing to its superior specific stiffness, specific strength, wear resistance, and thermal resistance as compared to the unreinforced aluminum alloys. In order to reduce engine weight, DRA materials are now being considered for space applications. Higher specific strength at ambient and cryogenic temperatures is one of the main requirements in certain rocket applications. The commercial DRA materials use 6xxx and 2xxx precipitation hardened aluminum alloys as matrices which have limited strengths. Therefore, an aluminum alloy which can provide significantly higher ambient and cryogenic strengths is required. In this paper, a novel aluminum alloy based on Al-Sc-X composition with improved ambient and cryogenic temperature strengthening capability is proposed. In addition, this alloy showed promise for improved strength at elevated temperature. The monolithic alloy and the composite with 15 volume percent SiC and B4C particles were processed using a powder metallurgy approach. The influence of processing parameters on the microstructures and mechanical properties of the monolithic and composite materials is discussed. The alloy showed very high strength and moderate ductility. The influence of hydrogen on the properties of monolithic and composite materials is discussed. The thermal stability of these materials is also evaluated. The strength of the material is discussed in terms of solid solution strengthening, Orowan strengthening, and antiphase boundary strengthening models.

Author

Composite Materials; Aluminum Alloys; Metal Matrix Composites; Wear Resistance; Thermal Resistance; Thermal Stability

20030062242 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA Development of Aerocapture Technologies

James, Bonnie; Munk, Michelle; Moon, Steve; [2003]; 4 pp.; In English; 17th AIAA Aerodynamic Decelerator Systems Technology Conference, 20-22 May 2003, Monterey, CA, USA; Copyright; Avail: CASI; A01, Hardcopy

Aeroassist technology development is a vital part of the NASA ln-Space Propulsion Program (ISP), which is managed by the NASA Headquarters Office of Space Science, and implemented by the Marshall Space Flight Center in Huntsville, Alabama. Aeroassist is the general term given to various techniques to maneuver a space vehicle within an atmosphere, using aerodynamic forces in lieu of propulsive fuel. Within the ISP, the current aeroassist technology development focus is aerocapture. The objective of the ISP Aerocapture Technology Project (ATP) is to develop technologies that can enable and/or benefit NASA science missions by significantly reducing cost, mass, and/or travel times. To accomplish this objective, the ATP identifies and prioritizes the most promising technologies using systems analysis, technology advancement and peer review, coupled with NASA Headquarters Office of Space Science target requirements. Plans are focused on developing

mid-Technology Readiness Level (TRL) technologies to TRL 6 (ready for technology demonstration in space).
Author
NASA Space Programs; Aeroassist; Aerodynamic Forces; Systems Analysis; Propulsion; Aerocapture

20030062255 Morgan Research Corp., Huntsville, AL, USA
NASA's Platform for Cross-Disciplinary Microchannel Research
Son, Sang Young; Spearing, Scott; Allen, Jeffrey; Monaco, Lisa A.; January 2003; 7 pp.; In English; 1st International Conference on Microchannels and Minichannels (ASME International), 24-25 Apr. 2003, Rochester, NY, USA
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: CASI; A02, Hardcopy

A team from the Structural Biology group located at the NASA Marshall Space Flight Center in Huntsville, Alabama is developing a platform suitable for cross-disciplinary microchannel research. The original objective of this engineering development effort was to deliver a multi-user flight-certified facility for iterative investigations of protein crystal growth; that is, Iterative Biological Crystallization (IBC). However, the unique capabilities of this facility are not limited to the low-gravity structural biology research community. Microchannel-based research in a number of other areas may be greatly accelerated through use of this facility. In particular, the potential for gas-liquid flow investigations and cellular biological research utilizing the exceptional pressure control and simplified coupling to macroscale diagnostics inherent in the IBC facility will be discussed. In conclusion, the opportunities for research-specific modifications to the microchannel configuration, control, and diagnostics will be discussed.
Author
Microchannel Plates; Microchannels; Space Platforms; Protein Crystal Growth; Two Phase Flow; Liquid-Gas Mixtures; Design Analysis

20030062264 NASA Glenn Research Center, Cleveland, OH, USA
Test Based Microgravity Analysis for the Fluids and Combustion Facility
McNelis, Mark E.; Yu, Albert Y.; Otten, Kim D.; Akers, James C.; June 2003; 12 pp.; In English; Noise-Con 2003, 23-25 Jun. 2003, Cleveland, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-400-35-10-01
Report No.(s): NASA/TM-2003-212355; E-13943; NAS 1.15:212355; No Copyright; Avail: CASI; A03, Hardcopy

The Fluids and Combustion Facility (FCF) is a two rack facility dedicated to combustion and fluids science in a microgravity (near zero-g) environment on board the International Space Station (ISS). An important aspect of performing on-orbit research is maintaining the rack microgravity environment by minimizing vibroacoustic disturbances generated within the science payload. This paper discusses recent rack-level acoustic emission testing to characterize the science payload microgravity environment. Measurements are compared with FCF microgravity science requirements.
Author
Microgravity; Vibrational Stress; Spaceborne Experiments; Acoustic Emission; Acoustic Measurement; Space Shuttle Payloads; Vibration

20030062944 NASA Langley Research Center, Hampton, VA, USA
Dot-Projection Photogrammetry and Videogrammetry of Gossamer Space Structures
Pappa, Richard S.; Black, Jonathan T.; Blandino, Joseph R.; Jones, Thomas W.; Danehy, Paul M.; Dorrington, Adrian A.; [2003]; 15 pp.; In English; 21st International Modal Analysis Conference, 3-6 Feb. 2003, Kissimmee, FL, USA; Copyright; Avail: CASI; A03, Hardcopy

This paper documents the technique of using hundreds or thousands of projected dots of light as targets for photogrammetry and videogrammetry of gossamer space structures. Photogrammetry calculates the three-dimensional coordinates of each target on the structure, and videogrammetry tracks the coordinates versus time. Gossamer structures characteristically contain large areas of delicate, thin-film membranes. Examples include solar sails, large antennas, inflatable solar arrays, solar power concentrators and transmitters, sun shields, and planetary balloons and habitats. Using projected-dot targets avoids the unwanted mass, stiffness, and installation costs of traditional retroreflective adhesive targets. Four laboratory applications are covered that demonstrate the practical effectiveness of white-light dot projection for both static-shape and dynamic measurement of reflective and diffuse surfaces, respectively. Comparisons are made between dot-projection videogrammetry and traditional laser vibrometry for membrane vibration measurements. The paper closes by introducing a

promising extension of existing techniques using a novel laser-induced fluorescence approach.
Author
Photogrammetry; Large Space Structures; Laser Induced Fluorescence; Spacecraft Structures; Solar Arrays

20030063138 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Investigation of the Characteristics of a High-Aspect-Ratio Wing in the Langley 8-Foot High-Speed Tunnel
Whitcomb, Richard T.; August 28, 1940; 78 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-L6H28a; No Copyright; Avail: CASI; A05, Hardcopy

An investigation of the characteristics of a wing with an aspect ratio of 9.0 and an NACA 65-210 airfoil section has been made at Mach number up to 0.925. The wing tested has a taper ratio of 2.5:1.0, no twist, dihedral, or sweepback, and 20-percent - chord 37.5-percent-semispan plain ailerons. The results showed that serious changes in the normal-force characteristics occurred when the Mach number was increased above 0.74 at angles of attack between 4 deg. and 10 deg. and above 0.80 at 0 deg. angle of attack.Because of small outboard shifts in the lateral center of load, the bending moment at the root for conditions corresponding to a 3g pull-out at an altitude of 35,000 feet increased by approximately 5\% when the Much number was increased beyond 0.83 the negative pitching moments for the high angles of attack increased, whereas those for the low angles of attack decreased with a resulting large increase in the negative slope of the pitching-moment curves. A large increase occurred in the values of the drag coefficients for the range of lift coefficients needed for level flight at an altitude of 35,000 feet when the Mach number was increased beyond a value of 0.80. The wakes at a station 2.82 root chords behind the wing quarter-chord line extended approximately a chord above the wing chord line for the angles of attack required to recover from high-speed dives at high Mach numbers.
Author
Aerodynamic Coefficients; Aerodynamic Drag; Wings; Ailerons; Bending Moments; High Speed

20030063141 Science Applications International Corp., Beltsville, MD, USA
Characteristics of Satellite Ocean Color Sensors: Past, Present and Future
Fargion, Giulietta S.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume VI: Special Topics in Ocean Optics Protocols and Appendices; April 2003, pp. 128-131; In English; See also 20030063139; No Copyright; Avail: CASI; A01, Hardcopy

This appendix summarizes the essential operational characteristics of ocean color sensors of the past, present and future. General characteristics of past and presently operating ocean color sensors are listed, including for each the satellite platform, country and agency, operational time period (actual or planned), orbit characteristics, spatial resolution at nadir, swath width, and tilt capabilities. The same information is listed for ocean color sensors currently planned for launch and operation in the future. The center wavelength, spectral bandwidth (FWHM) and noise equivalent radiance resolution (NEdeltaL) are listed for the ocean color bands of each of the sensors listed. Many of these sensors have additional bands, not listed here, addressing data requirements in terrestrial or atmospheric sciences. The information in these tables was updated from that published in IOCCG (1998). The sensor band data should be used to expand Table 4.1 when specifying in situ instrument characteristics needed to support algorithm development and validation related to any of the other sensors, in addition to SeaWiFS, which fall within the SIMBIOS purview.
Author
Ocean Color Scanner; Water Color; Physical Properties

20030063161 National Advisory Committee for Aeronautics. Ames Aeronautical Lab., Moffett Field, CA, USA
A Preliminary Study of Ram-Actuated Cooling Systems for Supersonic Aircraft
Stalder, Jackson R.; Wadleigh, Kenneth R.; April 29, 1947; 38 pp.; In English; Original contains black and white illustrations
Report No.(s): NACA-RM-A7C04; No Copyright; Avail: CASI; A03, Hardcopy

An analysis has been made of the characteristics of several cooling cycles suitable for cockpit cooling of supersonic aircraft. All the cycles considered utilize the difference between dynamic and ambient static pressure to actuate the cooling system and require no additional power source. The results of the study indicate that as flight speeds become greater, increasingly complex systems are required to reduce the altitudes above approximately 35,000 feet, a system composed of an externally loaded expansion turbine in conjunction with a supersonic diffuser would maintain tolerable ventilating air temperature, at least up to a flight Mach number of 2. The most complex system considered,composed of compressor, intercooler, and expansion turbine with the intercooler cooling air decreased in temperature by expansion through an auxiliary

turbine is capable of maintaining a ventilation air temperature less than ambient temperature up to a flight Mach number of 3.7.
Author
Cooling Systems; Cockpits; Ambient Temperature

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

20030062028 NASA Marshall Space Flight Center, Huntsville, AL, USA
Successful Development of an Automated Rendezvous and Capture System
Roe, Fred D.; Howard, Richard T.; [2002]; 1 pp.; In English; STAIF-2003, 2-6 Feb. 2003, Albuquerque, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

During the 1990's, the Marshall Space Flight Center (MSFC) conducted pioneering research in the development of an automated rendezvous and capture/docking system for U.S. space vehicles. Development and demonstration of a rendezvous sensor was identified early in the AR&C Program as the critical enabling technology that allows automated proximity operations and docking. A first generation rendezvous sensor, the Video Guidance Sensor (VGS) was developed and successfully flown on STS 87 and again on STS 95, proving the concept of a video-based sensor. Advances in both video and signal processing technologies and the lessons learned from the two successful flight experiments provided a baseline for the development, by the MSFC, of a new generation of video based rendezvous sensor. The Advanced Video Guidance Sensor (AVGS) has greatly increased performance and additional capability for longer-range operation with a new Target designed as a direct replacement for existing ISS hemispherical reflectors. A ground demonstration of the entire system and software was successfully tested.
Author
Guidance Sensors; Rendezvous Guidance; Signal Processing; Orbital Rendezvous; Spacecraft Docking; Video Signals

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20030062019 ATK-Thiokol Propulsion, Brigham City, UT, USA
Failure Criterion For Isotropic Time Dependent Materials Which Accounts for Multi-Axial Loading
Richardson, D. E.; Anderson, G. L.; Macon, D. J.; [2003]; 16 pp.; In English
Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: CASI; A03, Hardcopy

The Space Shuttle's Reusable Solid Rocket Motor (RSRM) nozzle program has recently conducted testing to characterize the effects of multi-axial loading, temperature and time on the failure characteristics of TIGA321, EA913NA, EA946 (three filled epoxy adhesives). From the test data a 'Multi-Axial, Temperature, and Time Dependent' or MATT failure criterion was developed. It is shown that this criterion simplifies, for constant load and constant load rate conditions, into a form that can be easily used for stress analysis. Failure for TIGA321 and EA913NA are characterized below their glass transition temperature. Failure for EA946 is characterized for conditions that pass through its glass transition. The MATT failure criterion is shown to be accurate for a wide range of conditions for these adhesives.
Author
Epoxy Resins; Stress Analysis; Failure; Adhesives; Solid Propellant Rocket Engines; Glass Transition Temperature

20030062052 CU Aerospace, LLC, Urbana, IL, USA
Ultrasail
Burton, R.; Benavides, G.; Coverston, V.; Hartmann, W.; Hargens, J.; Westerhoff, J.; Jones, Jonathan, Technical Monitor;

[2003]; 14 pp.; In English; Advance Space Propulsion Workshop, 15-17 Apr. 2003, Huntsville, AL, USA; Copyright; Avail: Other Sources

Ultrasail is a complete sail system for the launch, deployment, stabilization and control of very large solar sails enabling reduced mission times for interplanetary and deep space spacecraft. Ultrasail is an innovative, non-traditional approach to propulsion technology achieved by combining propulsion and control systems developed for formation-flying microsatellites with an innovative solar sail architecture to achieve sq km-class controllable sail areas, sail subsystem area densities of 1 gm per sq m, and thrust levels equivalent to 400 kW ion thruster systems used for comparable deep space missions. Ultrasail can conceivably even achieve outer planetary rendezvous, a deep space capability now reserved for high-mass nuclear and chemical systems. Ultrasail is a Delta IV-launched multi-blade spin-stabilized system with blade lengths as long as 50 km, reminiscent of the MacNeal Heliogyro. The primary innovation is the near-elimination of sail supporting structures by attaching the sail tip to a rigid formation-flying microsatellite truss which deploys the sail blade, and which then articulates the blade to provide attitude control, including spin stabilization and precession of the spin axis. These tip microsatellites are controlled by a solar-powered 3-axis microthruster system (electric or cold gas) to maintain proper sail film tension during deployment and spin-up. The satellite mass also provides a stabilizing centrifugal force on the blade while in rotation. Understanding the dynamics of individual blades is key to the overall dynamics of Ultrasail. Forces and torques that must be modeled include those due to solar pressure, those generated by the microsatellite at the blade tip and by torques applied at the blade root. Centrifugal forces also play a significant role in the deployment and maintenance of the sail configuration. To capture the dynamics of the overall system, the equations of motion for the blades have been derived. Using these differential equations, a control law will be derived to maneuver Ultrasail. This law involves the pitching of the individual blades thereby moving the distribution of the radiation pressure on each individual blade and inducing a resultant torque on the system. The direction of the angular momentum vector and its rate of precession can be controlled through the pitch angle of the blades. The Ultrasail trajectory is also being studied. Optimal or near-optimal trajectories are being generated to showcase Ultrasail performance. Various missions, e.g. outer planet and solar polar missions for observation of the Sun, are currently being investigated to demonstrate the performance enhancements generated by Ultrasail technology. Calculus-of-variations-based optimization software is used to produce optimal Ultrasail trajectories. The performance of these trajectories is being compared to optimal results generated with other propulsion models, including chemical propulsion, ion propulsion, and competing solar sail concepts. Results of these studies will quantify the performance of Ultrasail compared to existing solar sail concepts for high energy missions.

Author

Solar Sails; Spacecraft Propulsion; Propulsion System Configurations; Microsatellites; Spacecraft Design; Trajectory Analysis; Loads (Forces)

20030062058 NASA Marshall Space Flight Center, Huntsville, AL, USA

Antimatter Driven P-B11 Fusion Propulsion System

Kammash, Terry; Martin, James; Godfroy, Thomas; [2002]; 6 pp.; In English; STAIF 2003, 2-6 Feb. 2003, Albuquerque, NM, USA; Copyright; Avail: CASI; A02, Hardcopy

One of the major advantages of using P-B11 fusion fuel is that the reaction produces only charged particles in the form of three alpha particles and no neutrons. A fusion concept that lends itself to this fuel cycle is the Magnetically Insulated Inertial Confinement Fusion (MICF) reactor whose distinct advantage lies in the very strong magnetic field that is created when an incident particle (or laser) beam strikes the inner wall of the target pellet. This field serves to thermally insulate the hot plasma from the metal wall thereby allowing thc plasma to burn for a long time and produce a large energy magnification. If used as a propulsion device, we propose using antiprotons to drive the system which we show to be capable of producing very large specific impulse and thrust. By way of validating the confinement propenies of MICF we will address a proposed experiment in which pellets coated with P-B11 fuel at the appropriate ratio will be zapped by a beam of antiprotons that enter the target through a hole. Calculations showing the density and temperature of the generated plasma along with the strength of the magnetic field and other properties of the system will be presented and discussed.

Author

Matter-Antimatter Propulsion; Nuclear Propulsion; Spacecraft Propulsion; Antiprotons; Particle Beams; Propellants

20030062066 NASA Marshall Space Flight Center, Huntsville, AL, USA

Solar Thermal Propulsion Improvements at Marshall Space Flight Center

Gerrish, Harold P.; [2003]; 1 pp.; In English; Advanced Space Propulsion Workshop, 15-17 Apr. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Solar Thermal Propulsion (STP) is a concept which operates by transferring solar energy to a propellant, which thermally

expands through a nozzle. The specific impulse performance is about twice that of chemical combustions engines, since there is no need for an oxidizer. In orbit, an inflatable concentrator mirror captures sunlight and focuses it inside an engine absorber cavity/heat exchanger, which then heats the propellant. The primary application of STP is with upperstages taking payloads from low earth orbit to geosynchronous earth orbit or earth escape velocities. STP engines are made of high temperature materials since heat exchanger operation requires temperatures greater than 2500K. Refractory metals such as tungsten and rhenium have been examined. The materials must also be compatible with hot hydrogen propellant. MSFC has three different engine designs, made of different refractory metal materials ready to test. Future engines will be made of high temperature carbide materials, which can withstand temperatures greater than 3000K, hot hydrogen, and provide higher performance. A specific impulse greater than 1000 seconds greatly reduces the amount of required propellant. A special 1 OkW solar ground test facility was made at MSFC to test various STP engine designs. The heliostat mirror, with dual-axis gear drive, tracks and reflects sunlight to the 18 ft. diameter concentrator mirror. The concentrator then focuses sunlight through a vacuum chamber window to a small focal point inside the STP engine. The facility closely simulates how the STP engine would function in orbit. The flux intensity at the focal point is equivalent to the intensity at a distance of 7 solar radii from the sun.
Author
Solar Thermal Propulsion; Upper Stage Rocket Engines; Heat Exchangers; Refractory Metals; Hydrogen Fuels

20030062091 NASA Marshall Space Flight Center, Huntsville, AL, USA
Technology Development of a Fiber Optic-Coupled Laser Ignition System for Multi-Combustor Rocket Engines
Trinh, Huu P.; Early, Jim; Osborne, Robin; Thomas, Matthew E.; Bossard, John A.; December 03, 2002; 10 pp.; In English; Propulsion Engineering Research Center 14th Symposium on Propulsion, 10-11 Dec. 2002, State College, PA, USA; Copyright; Avail: CASI; A02, Hardcopy

This paper addresses the progress of technology development of a laser ignition system at NASA Marshall Space Flight Center (MSFC). The first two years of the project focus on comprehensive assessments and evaluations of a novel dual-pulse laser concept, flight- qualified laser system, and the technology required to integrate the laser ignition system to a rocket chamber. With collaborations of the Department of Energy/Los Alamos National Laboratory (LANL) and CFD Research Corporation (CFDRC), MSFC has conducted 26 hot fire ignition tests with lab-scale laser systems. These tests demonstrate the concept feasibility of dual-pulse laser ignition to initiate gaseous oxygen (GOX)/liquid kerosene (RP-1) combustion in a rocket chamber. Presently, a fiber optic- coupled miniaturized laser ignition prototype is being implemented at the rocket chamber test rig for future testing. Future work is guided by a technology road map that outlines the work required for maturing a laser ignition system. This road map defines activities for the next six years, with the goal of developing a flight-ready laser ignition system.
Author
Ignition Systems; Laser Applications; Pulsed Lasers; Rocket Engines; Computational Fluid Dynamics

20030062093 NASA Marshall Space Flight Center, Huntsville, AL, USA
Quasi 1-D Study of Pulse Detonation Rocket Engine Blowdown Gasdynamics and Performance
Morris, Christopher I.; December 2, 2002; 8 pp.; In English; Propulsion Engineering Research Center 14th Annual Symposium on Propulsion, 10-11 Dec. 2002, State College, PA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Pulse detonation rocket engines (PDREs) offer potential performance improvements over conventional designs, but represent a challenging modeling task. A quasi 1-D, finite-rate chemistry CFD model for a PDRE is described and implemented. A parametric study of the effect of blowdown pressure ratio on the performance of several different PDRE nozzle configurations is reported.
Author
Pulse Detonation Engines; Pressure Effects; Computational Fluid Dynamics; Propulsion System Performance

20030062108 NASA Marshall Space Flight Center, Huntsville, AL, USA
Phenomenological Model of Current Sheet Canting in Pulsed Electromagnetic Accelerators
Markusic, Thomas; Choueiri, E. Y.; [2003]; 10 pp.; In English; 28th International Electric Propulsion Conference, 17-21 Mar. 2003, Toulouse, France; Copyright; Avail: CASI; A02, Hardcopy

The phenomenon of current sheet canting in pulsed electromagnetic accelerators is the departure of the plasma sheet (that carries the current) from a plane that is perpendicular to the electrodes to one that is skewed, or tipped. Review of pulsed electromagnetic accelerator literature reveals that current sheet canting is a ubiquitous phenomenon - occurring in all of the standard accelerator geometries. Developing an understanding of current sheet canting is important because it can detract from

the propellant sweeping capabilities of current sheets and, hence, negatively impact the overall efficiency of pulsed electromagnetic accelerators. In the present study, it is postulated that depletion of plasma near the anode, which results from axial density gradient induced diamagnetic drift, occurs during the early stages of the discharge, creating a density gradient normal to the anode, with a characteristic length on the order of the ion skin depth. Rapid penetration of the magnetic field through this region ensues, due to the Hall effect, leading to a canted current front ahead of the initial current conduction channel. In this model, once the current sheet reaches appreciable speeds, entrainment of stationary propellant replenishes plasma in the anode region, inhibiting further Hall-convective transport of the magnetic field; however, the previously established tilted current sheet remains at a fairly constant canting angle for the remainder of the discharge cycle, exerting a transverse J x B force which drives plasma toward the cathode and accumulates it there. This proposed sequence of events has been incorporated into a phenomenological model. The model predicts that canting can be reduced by using low atomic mass propellants with high propellant loading number density; the model results are shown to give qualitative agreement with experimentally measured canting angle mass dependence trends.
Author
Current Sheets; Magnetic Fields; Electromagnetic Acceleration; Hall Effect; Diamagnetism

20030062116 NASA Marshall Space Flight Center, Huntsville, AL, USA
Early Flight Fission Test Facilities (EFF-TF) and Concepts That Support Near-Term Space Fission Missions
VanDyke, Melissa; Houts, Mike; Godfroy, Thomas; Martin, James; [2003]; 7 pp.; In English; International Congress on Advanced Nuclear Power Plants 2003, 4-7 May 2003, Cordoba, Spain
Report No.(s): Paper-3342; No Copyright; Avail: CASI; A02, Hardcopy

Fission technology can enable rapid, affordable access to any point in the solar system. If fusion propulsion systems are to be developed to their full potential; however, near-term customers must be identified and initial fission systems successfully developed, launched, and utilized. Successful utilization will most likely occur if frequent, significant hardware-based milestones can be achieved throughout the program. If the system is designed to operate within established radiation damage and fuel burn up limits while simultaneously being designed to allow close simulation of heat from fission using resistance heaters, high confidence in fission system pe$ormance and lifetime can be attained through non-nuclear testing. Through demonstration of systems concepts (designed by DOE National Laboratories) in relevant environments, this philosophy has been demonstrated through hardware testing in the Early Flight Fission Test Facilities (EFF-TF) at the Marshall Space Flight Center. The EFF-TF is designed to enable very realistic non-nuclear testing of space fission systems. Ongoing research at the EFF-TF is geared towards facilitating research, development, system integration, and system utilization via cooperative efforts with DOE labs, industry, universities, and other NASA centers.
Author
Fission; Propulsion System Configurations; Propulsion System Performance; Test Facilities; Systems Integration; Aerospace Systems

20030062129 NASA Marshall Space Flight Center, Huntsville, AL, USA
Liquid-Metal-Fed Pulsed Plasma Thrusters
Markusic, Thomas; [2003]; 1 pp.; In English; Advanced Space Propulsion Workshop (ASPW 2003), 15-17 Apr. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Liquid metal propellants may provide a path toward more reliable and efficient pulsed plasma thrusters (PPTs). Conceptual thruster designs which eliminate the need for high current switches and propellant metering valves are described. Propellant loading techniques are suggested that, at least in principle, show promise to increase propellant utilization, dynamic, and electrical efficiency. Experimental results from a prototype electromagnetically-pumped propellant feed system, and experiments in the initiation of arc discharges in liquid metal droplets, are presented.
Author
Liquid Metals; Metal Propellants; Pulsed Plasma Thrusters

20030062141 NASA Marshall Space Flight Center, Huntsville, AL, USA
Characterization of Candidate Solar Sail Materials Subjected to Electron Radiation
Edwards, David; Hubbs, Whitney; Stanaland, Tesia; Hollerman, Andy; Semmel, Charles; [2003]; 2 pp.; In English; 9th International Symposium on Materials in a Space Environment, 16-20 Jun. 2003, Noordwijk, Netherlands; Copyright; Avail: Other Sources; Abstract Only

The National Aeronautics and Space Administration's Marshall Space Flight Center (MSFC) is concentrating research

into the utilization of ultra lightweight materials for spacecraft propulsion. The Space Environmental Effects Team at MSFC is actively characterizing candidate solar sail material to evaluate the thermo-optical and mechanical properties after exposure to space environmental effects. Radiation, from a variety of sources, exists in the space environment with low energy electrons primarily dominating the distribution. Practical sails must be resistant to the effects of long duration electron exposure. For this reason, research was initiated using a 95 keV electron source to determine the hardness of several candidate sail materials. Hardness in this context is defined as the amount of electron fluence (electrons/area) required to cause the sail material to fail. Solar sails are generally composed of a highly reflective metallic front layer, a thin polymeric substrate, and occasionally a highly emissive back surface, State-of-the-art candidate solar sail materials are generally composed of a polymeric substrate that is 2 to 3 microns thick. This polymeric film is coated with a thin metallic layer, usually aluminum. A typical thickness for this metallic layer is 50 nm. Two candidate solar sail materials, aluminized Mylar(trademark) and aluminized Kapton(trademark) were characterized. A radiation dose versus material depth profile was generated for each candidate sail material. This dose-depth profile was used to determine the relationship between the 95 keV electron fluence and radiation dose in the sail material. The focus of this investigation was to determine the effect of a uniform dose of 95 keV electron radiation on the sail material mechanical properties. Candidate sail materials were loaded, in tension, and stress relaxation as a function of time was recorded in vacuum. Stress relaxation data was obtained for sail materials that were exposed to 95 keV electron radiation and also for sail materials not exposed to radiation. The radiation dose levels for both materials exceeded 600 Megarads (Mrads). The results of this investigation indicate the aluminized Mylar(trademark) experienced a noticeable degree of mechanical property degradation. The aluminized Kapton(trademark) appears to have a higher tolerance to electron radiation exposure. Additional research using more mission specific electron environments will be completed in the future. This paper will discuss the preliminary results of this research.
Author
Solar Sails; Mechanical Properties; Materials Selection; Radiation Effects; Fatigue Tests; Fatigue (Materials); Optical Properties

20030062158 NASA Marshall Space Flight Center, Huntsville, AL, USA
Advanced Propulsion Research Interest in Materials for Propulsion
Cole, John; [2003]; 12 pp.; In English; Materials Science for Advanced Space Propulsion Workshop, 15-16 May 2003, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides an overview of material science and technology in the area of propulsion energetics. The authors note that conventional propulsion systems are near peak performance and further refinements in manufacturing, engineering design and materials will only provide incremental increases in performance. Energetic propulsion technologies could potential solve the problems of energy storage density and energy-to-thrust conversion efficiency. Topics considered include: the limits of thermal propulsion systems, the need for energetic propulsion research, emerging energetic propulsion technologies, materials research needed for advanced propulsion, and potential research opportunities.
Author
Propulsion System Configurations; Spacecraft Propulsion; Propulsion; Research And Development; Energy Conversion Efficiency; Energy Storage; Materials Science

20030062159 ATK-Thiokol Propulsion, Brigham City, UT, USA
Measuring the Internal Environment of Solid Rocket Motors During Ignition
Weisenberg, Brent; Smith, Doug; Speas, Kyle; Corliss, Adam; February 2003; 10 pp.; In English; Propulsion Measurement Sensor Development Workshop, 13-15 May 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A02, Hardcopy

A new instrumentation system has been developed to measure the internal environment of solid rocket test motors during motor ignition. The system leverages conventional, analog gages with custom designed, electronics modules to provide safe, accurate, high speed data acquisition capability. To date, the instrumentation system has been demonstrated in a laboratory environment and on subscale static fire test motors ranging in size from 5-inches to 24-inches in diameter. Ultimately, this system is intended to be installed on a full-scale Reusable Solid Rocket Motor. This paper explains the need for the data, the components and capabilities of the system, and the test results.
Author
Solid Propellant Rocket Engines; Measuring Instruments; Data Acquisition; Static Tests; Ignition Systems

20030062167 NASA Marshall Space Flight Center, Huntsville, AL, USA

Pulse Detonation Rocket Engine Research at NASA Marshall

Morris, Christopher I.; May 09, 2003; 16 pp.; In English; 16th ONR Propulsion Meeting, 9-11 Jun. 2003, Los Angeles, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation provides an overview of research being conducted on Pulse Detonation Rocket Engines (PDRE) by the Propulsion Research Center (PRC) at the Marshall Space Flight Center. PDREs have a theoretical thermodynamic advantage over Steady-State Rocket Engines (SSREs) although unsteady blowdown processes complicate effective use of this advantage in practice; PRE is engaged in a fundamental study of PDRE gas dynamics to improve understanding of performance issues. Topics covered include: simplified PDRE cycle, comparison of PDRE and SSRE performance, numerical modeling of quasi 1-D rocket flows, time-accurate thrust calculations, finite-rate chemistry effects in nozzles, effect of F-R chemistry on specific impulse, effect of F-R chemistry on exit species mole fractions and PDRE performance optimization studies.

Author

Pulse Detonation Engines; Gas Dynamics; Performance Tests; Detonation; Performance Prediction; Thermochemistry; Thermodynamic Properties

20030062171 Pennsylvania State Univ., University Park, PA, USA

Sea-Level Static Testing of the Penn State Two-Dimensional Rocket-Based Combined Cycle (RBCC) Testbed

Cramer, J. M.; Pal, S.; Marshall, W. M.; Santoro, R. J.; January 2003; 11 pp.; In English; MSFC Fall Fluids Workshop 2002, 19-21 Nov. 2002, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-40890; No Copyright; Avail: CASI; A03, Hardcopy

The present results indicated that: 1.Significant RBCC ejector mode database has been generated for single and twin thruster configuration and for global and local measurements. 2. Ongoing analysis and correlation effort for MSFC CFD modeling and turbulent shear layer analysis was completed. 3. The potential follow-on activities are: detailed measurements of air flow static pressure and velocity profiles; investigation other thruster spacing configurations; performing fundamental shear layer mixing study; and demonstrating single-shot Raman measurements.

CASI

Rocket-Based Combined-Cycle Engines; Static Pressure; Shear Layers; Two Dimensional Models; Data Bases; Turbulence

20030062174 NASA Marshall Space Flight Center, Huntsville, AL, USA

Electron Exposure Measurements of Candidate Solar Sail Materials

Albarado, Tesia; Hollerman, W. A.; Edwards, David; Hubbs, Whitney; Semmel, Charles; [2003]; 10 pp.; In English; International Solar Energy Conference, 15-18 Mar. 2003, Kohala Coast, HI, USA; Copyright; Avail: Other Sources; Abstract Only

Solar sailing is a unique form of propulsion where a spacecraft gains momentum from incident photons. Since sails are not limited by reaction mass, they provide continual acceleration, reduced only by the lifetime of the lightweight film in the space environment and the distance to the Sun. Practical solar sails can expand the number of possible missions that are difficult by conventional means. The National Aeronautics and Space Administration's Marshall Space Flight Center (MSFC) is concentrating research into the utilization of ultra lightweight materials for spacecraft propulsion. Solar sails are generally composed of a highly reflective metallic front layer, a thin polymeric substrate, and occasionally a highly emissive back surface. The Space Environmental Effects Team at MSFC is actively characterizing candidate sails to evaluate the thermo-optical and mechanical properties after exposure to electrons. This paper will discuss the preliminary results of this research.

Author

Spacecraft Construction Materials; Solar Sails; Spacecraft Propulsion; Radiation Effects; Mechanical Properties; Thermodynamic Properties; Electron Radiation

20030062180 NASA Marshall Space Flight Center, Huntsville, AL, USA

Pulse Detonation Rocket Engine Research at NASA Marshall

Morris, Christopher I.; May 9, 2003; 6 pp.; In English; 16th ONR Propulsion Meeting, 9-11 Jun. 2003, Los Angeles, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Pulse detonation rocket engines (PDREs) offer potential performance improvements over conventional designs, but represent a challenging modeling task. A quasi 1-D, finite-rate chemistry CFD model for a PDRE is described and

implemented. A parametric study of the effect of blowdown pressure ratio on the performance of an optimized, fixed PDRE nozzle configuration is reported. The results are compared to a steady-state rocket system using similar modeling assumptions. Author

Pulse Detonation Engines; Computational Fluid Dynamics; Pressure Ratio; Pressure Effects

20030062182 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA/MSFC Interest in Advanced Propulsion and Power Technologies

Cole, John W.; [2003]; 10 pp.; In English; EETEAMS, 2 Apr. 2003, Huntsville, AL, USA; No Copyright; Avail: CASI; A02, Hardcopy

This viewgraph representation provides an overview of research being conducted at NASA's Marshall Space Flight Center. Conventional propulsion systems are at near peak performance levels but will not enable the science and exploration deep space missions NASA envisions. Energetic propulsion technologies can make these missions possible but only if the fundamental problems of energy storage density and energy to energy thrust conversion efficiency are solved. Topics covered include: research rationale, limits of thermal propulsion systems, need for propulsion energetics research, emerging energetic propulsion technologies, and potential research opportunities.

Author

Spacecraft Propulsion; Propulsion System Performance; Energy Conversion Efficiency; Energy Storage; Research And Development; Materials Science

20030062186 NASA Marshall Space Flight Center, Huntsville, AL, USA

Combustion Devices CFD Simulation Capability Roadmap

West, Jeff; Tucker, P. Kevin; Williams, Robert W.; April 24, 2003; 33 pp.; In English; NASA Spring Workshop on Fluids, 22-24 Apr. 2003, Birmingham, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this roadmap is to enable the use of CFD for simulation of pre-burners, ducting, thrust chamber assembly and supporting infrastructure in terms of performance, life, and stability so as to affect the design process in a timely fashion. To enable flange to exit analysis of real(3D) propulsion hardware within the last 5 years (2008). To meet this objective all model problems must be sufficiently mastered.

Derived from text

Computational Fluid Dynamics; Simulation; Combustion; Burners; Thrust Chambers

20030062189 NASA Marshall Space Flight Center, Huntsville, AL, USA

Quasi 1-D Study of Pulse Detonation Rocket Engine Blowdown Gasdynamics and Performance

Morris, Christopher; 2 Dec. 2002; 15 pp.; In English; Propulsion Engineering Research Center 14th Annual Symposium on Propulsion, 10-11 Dec. 2002, State College, PA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation provides an overview of research which develops a quasi one dimensional chemistry computational fluid dynamics code to study the effect of nozzle design on the performance of pulse detonation rocket engines (PDREs). Topics considered include: PDREs vs. steady-state rocket engines (SSREs), PDRE cycles, numerical models of idealized PDRE performance, thrust determination of PDRE, specific geometries, and nozzle design and geometry.

CASI

Pulse Detonation Engines; Computational Fluid Dynamics; Gas Dynamics; Nozzle Design; Detonation; Geometry; Mathematical Models

20030062200 ATK-Thiokol Propulsion, Huntsville, AL, USA

Techniques for the Installation of Internal Fiber Optic Instrumentation on an 11-Inch Hybrid Motor Test Bed

Cornelius, Michael; Smartt, Ziba; Henrie, Vaughn; Johnson, Mont; [2003]; 20 pp.; In English; Propulsion Measurement Sensor Development Workshop, 13-15 May 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A03, Hardcopy

The recent developments in Fabry-Perot fiber optic instruments have resulted in accurate transducers with some of the physical characteristics required for use in obtaining internal data from solid rocket motors. These characteristics include small size, non-electrical excitation, and immunity to electro-magnetic interference. These transducers have not been previously utilized in this environment due to the high temperatures typically encountered. A series of tests were conducted using a 1 1-Inch Hybrid test bed to develop installation techniques that will allow the fiber optic instruments to survive and obtain data for a short period of time following the motor ignition. The installation methods developed during this test series have the

potential to allow data to be acquired in the motor chamber, propellant bore, and nozzle during the ignition transient. These measurements would prove to be very useful in the characterization of current motor designs and provide insight into the requirements for further refinements. The process of developing these protective methods and the installation techniques used to apply them is summarized.
Author
Fiber Optics; Solid Propellant Rocket Engines; Installing; Transducers

20030062253 NASA Marshall Space Flight Center, Huntsville, AL, USA
Momentum and Heat Flux Measurements in the Exhaust of VASIMR using Helium Propellant
Chavers, D. Gregory; Chang-Diaz, Franklin R.; Irvine, Claude; Squire, Jared P.; [2003]; 10 pp.; In English; 28th International Electric Propulsion Conference, 17-21 Mar. 2003, Toulouse, France; Copyright; Avail: CASI; A02, Hardcopy

Interplanetary travel requires propulsion systems that can provide high specific impulse (Isp), while also having sufficient thrust to rapidly accelerate large payloads. One such propulsion system is the Variable Specific Impulse Magneto-plasma Rocket (VASIMR), which creates, heats, and ejects plasma to provide variable thrust and Isp, designed to optimally meet the mission requirements. The fraction of the total energy invested in creating the plasma, as compared to the plasma s total kinetic energy, is an important factor in determining the overall system efficiency. In VASIMR, this frozen flow loss is appreciable when at high thrust, but negligible at high Isp. The loss applies to other electric thrusters as well. If some of this energy could be recovered through recombination processes, and re-injected as neutral kinetic energy, the efficiency of VASIMR, in its low Isp/high thrust mode may be improved. An experiment is being conducted to investigate the possibility of recovering some of the energy used to create the plasma by studying the flow characteristics of the charged and neutral particles in the exhaust of the thruster. This paper will cover the measurements of momentum flux and heat flux in the exhaust of the VASIMR test facility using helium as the propellant where the heat flux is comprised of both kinetic and plasma recombination energy. The flux measurements also assist in diagnosing and verifying the plasma conditions in the existing experiment.
Author
Specific Impulse; Propulsion System Configurations; Propulsion System Performance; Heat Flux; High Impulse; Momentum; Magnetohydrodynamic Flow; Variable Thrust

20030062768 SRS TECHNOLOGIES HUNTSVILLE AL, Huntsville, AL, USA
Inflatable Concentrators for Solar Thermal Propulsion
Clayton, William R.; Gierow, Paul A.; Jan. 1992; 8 pp.; In English
Report No.(s): AD-A412158; No Copyright; Avail: CASI; A02, Hardcopy

A solar thermal propulsion system with inflatable solar concentrators was originally described by Eliricke in 1956. This concept was further defined by Electro-Optical Systems, Inc. during the 1960's and by Rockwell International in 1979. The Solar Powered Rocket Engine is expected to produce specific impulses of i 900 to 1200 seconds. This is over two to three times that of conventional liquid hydrogenloxygen engines. This performance would significantly improve travel from low earth orbit to geostationary earth orbit and other planets.
DTIC
Solar Thermal Propulsion; Rockets

20030062877 Michigan Univ., Dearborn, MI, USA
Numerical and Physical Modeling of Tube Hydroforming
Kridli, G. T.; Orady, E. A.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 343-351; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Tube hydroforming is a manufacturing process in which an internal hydraulic pressure is applied to transform either a straight or a pre-bent tubular blank into a structural component with different or varying cross-sectional shapes along its length. High pressure tube hydroforming is the most common form of the tube hydroforming process in which a tubular blank is placed in a closed die and the internal hydraulic pressure forces the tube to conform to the shape of the die cavity. In order to reduce thinning in the tube wall, the tube ends are fed into the die cavity by the use of hydraulic cylinders. Punches may also be mounted in the die to pierce holes in the tube wall during the forming operation. A schematic of the loading scheme is shown with F(sub e), denoting end feed and P denoting the internal pressure for a tube with radius r, wall thickness t, and length l. In this exercise, tubes are formed in the laboratory, under different processing conditions, to demonstrate the different modes of failure, and the conditions that can lead to defect free hydroformed parts. Numerical modeling of the tube

hydroforming process is conducted using the finite element tool DYNAFORM, and the model is analyzed using the finite element analysis code LS-DYNA. The hydroformed tubes are cut into sections, and thickness measurements are made along these sections. The physical test results are then compared with the numerical results. Students completing this exercise learn to identify the effects of processing parameters on the final product, and are introduced to numerical modeling tools for metal forming.
Author
Mathematical Models; Finite Element Method; Hydroforming; Failure Analysis; Fatigue Life; Thickness; Computerized Simulation; Mechanical Properties

20030062907 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 5, Acquire Express-A3 SPT?100 Based Propulsion Subsystem and Other Subsystem Flight Operation TM-Data, Task 31
Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 74 pp.; In English
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT5; E-13691-5/PT5; NAS 1.26:212005/PT5; No Copyright; Avail: CASI; A04, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80deg E. and 11deg W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3-99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Hall Effect; Propulsion System Configurations; Propulsion System Performance; Communication Satellites; Electric Field Strength; Hall Thrusters

20030062908 Nauchno-Proizvodstvennoe Obedinenie Prikladnoi Mekhaniki, Krasnoyarsk, Russia
Hall Effect Thruster Interactions Data From the Russian Express-A2 and Express-A3 Satellites, Part 4, Acquire TM-Data for Type A and Type B Sensors for 'Express-A' Number 3 Satellite, Task 27A
Sitnikova, N.; Volkov, D.; Maximov, I.; Petrusevich, V.; Allen, D.; June 2003; 368 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-99151; NAS3-99204; WBS 22-800-91-01
Report No.(s): NASA/CR-2003-212005/PT4; E-13691-4/PT4; NAS 1.26:212005/PT4; No Copyright; Avail: CASI; A16, Hardcopy

This 12-part report documents the data obtained from various sensor measurements taken aboard the Russian Express-A2 and Express-A3 spacecraft in Geosynchronous Earth Orbit (GEO). These GEO communications satellites, which were designed and built by NPO Prikladnoy Mekhaniki (NPO PM) of Zheleznogorsk, Russia, utilize Hall thruster propulsion systems for north-south and east-west stationkeeping and as of June 2002, were still operating at 80deg E., and 11deg W., respectively. Express-A2 was launched on March 12, 2000, while Express-A3 was launched on June 24, 2000. The diagnostic equipment from which these data were taken includes electric field strength sensors, ion current and energy sensors, and pressure sensors. The diagnostics and the Hall thruster propulsion systems are described in detail along with lists of tabular data from those diagnostics and propulsion system and other satellite systems. Space Power, Inc., now part of Pratt & Whitney's Chemical Systems Division, under contract NAS3-99151 to the NASA Glenn Research Center, obtained these data over several periods from March 12, 2000, through September 30, 2001. Each of the 12 individual reports describe, in detail, the propulsion systems as well as the diagnostic sensors utilized. Finally, parts 11 and 12 include the requirements to which NPO PM prepared and delivered these data.
Author
Hall Thrusters; Propulsion System Performance; Electric Field Strength; Communication Satellites; Hall Effect; Propulsion System Configurations

20030062970 Air Force Research Lab., Edwards AFB, CA, USA
Liquid Rocket Propulsion - Evolution and Advancements: Rocket-Based Combined Cycle
Moszee, Ray; Jun. 25, 1999; 49 pp.; In English
Contract(s)/Grant(s): Proj-3058
Report No.(s): AD-A411560; AFRL-PR-ED-TP-FY99-0098; No Copyright; Avail: CASI; A03, Hardcopy

This document on Rocket-Based Combined Cycles discusses history of RBCC, integrated performance analysis, current activities and future prospects.

DTIC
Liquid Propellant Rocket Engines; Ascent Propulsion Systems

20030062975 Air Force Research Lab., Edwards AFB, CA, USA
Small Intercontinental Ballistic Missile (SICBM) Rocket Motor Sympathetic Detonation Study
Schwartz, Daniel F.; Merrill, Claude E.; Mar. 10, 2003; 18 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A411630; AFRL-PR-ED-TP-2003-064; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force Research Laboratory (AFRL) Propulsion Directorate at Edwards Air Force Base California utilized two surplus Small Intercontinental Ballistic Missile (SICBM) rocket motors in a sympathetic detonation test with a spacing of 15 feet (4.5 meters) between them (typical max spacing in storage bunkers and transport trailers) to gain technical value from assets deemed undesirable for test firing. The Stage 1 SICBM motor containing 19,200 lbs (8709 kg) of detonable Hazard Division (HD) 1.1 propellant was used as the donor motor and the Stage 3 SICBM motor containing 3040 lbs (1379 kg) of the same propellant formulation was used as the acceptor motor in the test. It was assumed that the propellant and rocket motor community would be interested in observing how large the differential can be between detonation by Shock-to-Detonation Transition (SDT) initiation values and by lesser shocks that might occur with operational scenarios of nearby detonation shocks or flight fallbacks. In addition, observation of fragment throw/impact data from modem, carbon composite, case rocket motors could help determine fragment hazards from such events. Such data might provide the modeling and simulation community information that could be coupled to rocket motor hazard codes for predicting rocket motor responses to shock and fragment stimuli. This paper outlines the sympathetic detonation test conducted at AFRL, to observe interactions between a detonating Stage 1 Small ICBM rocket motor and a nearby Stage 3 Small ICBM rocket motor.

DTIC
Detonation; Intercontinental Ballistic Missiles; Rocket Engines; Military Technology

20030063014 Pennsylvania State Univ., University Park, PA, USA
Recent Experimental Results Related to Ejector Mode Studies of Rocket-Based Combined Cycle (RBCC) Engines
Cramer, J. M.; Pal, S.; Marshall, W. M.; Santoro, R. J.; [2003]; 21 pp.; In English; MSFC Spring Fluids Workshop, 23 Apr. 2003, Birmingham, AL, USA
Contract(s)/Grant(s): NAS8-40890; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the folloving: 1. Motivation. Support NASA's 3d generation launch vehicle technology program. RBCC is promising candidate for 3d generation propulsion system. 2. Approach. Focus on ejector mode p3erformance (Mach 0-3). Perform testing on established flowpath geometry. Use conventional propulsion measurement techniques. Use advanced optical diagnostic techniques to measure local combustion gas properties. 3. Objectives. Gain physical understanding of detailing mixing and combustion phenomena. Establish an experimental data set for CFD code development and validation. Derived from text
Experimentation; Data Acquisition; Ejectors; Mode; Rocket-Based Combined-Cycle Engines

20030063049 Air Force Research Lab., Edwards AFB, CA, USA
Reusable Orbit Transfer Vehicle Propulsion Technology Considerations
Perkins, Dave; Jul. 9, 1998; 12 pp.; In English
Contract(s)/Grant(s): Proj-3058
Report No.(s): AD-A411599; AFRL-PR-ED-TP-1998-150; No Copyright; Avail: CASI; A03, Hardcopy

A summary of these viewgraphs is: ROTVs (reusable orbit transfer vehicles) enable space tugs and space salvage. ROTV for space transportation has a lot to prove to PLS. Ground based better than space based ROTV. ROTV propulsion technologies to consider chemical rockets have limited mission capture, solar thermal rockets capture most missions but LH2

issues, and electric has highest PL without volume constraint. All technologies require more money to enable ROTV.
DTIC
Space Transportation; Spacecraft Propulsion; Orbit Transfer Vehicles

20030063051 NASA Marshall Space Flight Center, Huntsville, AL, USA
Momentum and Heat Flux Measurements in the Exhaust of VASIMR using Helium Propellant
Chavers, D. Gregory; Chang-Diaz, Franklin R.; Irvine, Claude; Squire, Jared P.; [2003]; 10 pp.; In English; 28th International Electric Propulsion Conference, 17-21 Mar. 2003, Toulouse, France; Copyright; Avail: CASI; A02, Hardcopy

Interplanetary travel requires propulsion systems that can provide high specific impulse (Isp), while also having sufficient thrust to rapidly accelerate large payloads. One such propulsion system is the Variable Specific Impulse Magneto-plasma Rocket (VASIMR), which creates, heats, and ejects plasma to provide variable thrust and Isp, designed to optimally meet the mission requirements. The fraction of the total energy invested in creating the plasma, as compared to the plasma's total kinetic energy, is an important factor in determining the overall system efficiency. In VASIMR, this 'frozen flow loss' is appreciable when at high thrust, but negligible at high Isp. The loss applies to other electric thrusters as well. If some of this energy could be recovered through recombination processes, and reinjected as neutral kinetic energy, the efficiency of VASIMR, in its low Isp/high thrust mode may be improved. An experiment is being conducted to investigate the possibility of recovering some of the energy used to create the plasma by studying the flow characteristics of the charged and neutral particles in the exhaust of the thruster. This paper will cover the measurements of momentum flux and heat flux in the exhaust of the VASIMR test facility using helium as the propellant where the heat flux is comprised of both kinetic and plasma recombination energy. The flux measurements also assist in diagnosing and verifying the plasma conditions in the existing experiment.
Author
Charged Particles; Flow Characteristics; Heat Flux; Magnetoplasmadynamic Thrusters; Propulsion System Performance; Propulsive Efficiency; Neutral Particles; Electron Recombination; Exhaust Emission; Helium

20030063063 Massachusetts Inst. of Tech., Cambridge, MA
Jets and Sprays Emitted from Colloid Thrusters-Experiments and Modeling
Lozano, Paulo; Martinez-Sanchez, Manuel; Jan. 2003; 8 pp.; In English
Report No.(s): AD-A411642; No Copyright; Avail: CASI; A02, Hardcopy

The spreading angle of an electrospray of Formamide with 5-10\% LiCl by mass has been measured to be 18 inches in vacuum, for conditions close to minimum stable flow. A single-stage einzel lens was able to re-focus the spray, as predicted by paraxial ray theory. In addition, a time-dependent 1-D numerical model of the cone-jet-spray structure is described, and initial results presented.
DTIC
Thrustors; Propellants; Colloids; Mathematical Models; Spraying; Lithium Chlorides

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20030062078 NASA Marshall Space Flight Center, Huntsville, AL, USA
The NASA Materials Science Research Program - It's New Strategic Goals and Plans
Schlagheck, Ronald A.; [2003]; 1 pp.; In English; Materials Science Paper at the Spacebound 2003 Conference, 4-10 May 2003, Toronto, Canada; No Copyright; Avail: Other Sources; Abstract Only

In 2001, the NASA created a separate science enterprise, the Office of Biological and Physical Research (OBPR), to perform strategical and fundamental research bringing together physics, chemistry, biology, and engineering to solve problems needed for future agency mission goals. The Materials Science Program is one of basic research disciplines within this new Enterprise's Division of Physical Sciences Research. The Materials Science Program participates to utilize effective use of International Space Station (ISS) experimental facilities, target new scientific and technology questions, and transfer results for Earth benefits. The program has recently pursued new investigative research in areas necessary to expand NASA knowledge base for exploration of the universe, some of which will need access to the microgravity of space. The program has a wide variety of traditional ground and flight based research related types of basic science related to materials

crystallization, fundamental processing, and properties characterization in order to obtain basic understanding of various phenomena effects and relationships to the structures, processing, and properties of materials. A summary of the types and sources for this research is presented and those experiments planned for the space. Areas to help expand the science basis for NASA future missions are described. An overview of the program is given including the scope of the current and future NASA Research Announcements with emphasis on new materials science initiatives. A description of the planned flight experiments to be conducted on the International Space Station program along with the planned facility class Materials Science Research Rack (MSRR) and Microgravity Glovebox (MSG) type investigations.
Author
NASA Programs; Materials Science; Research; Microgravity

20030062102 Houston Univ., TX, USA
The Physics of Protein Crystallization
Vekilov, P. G.; Chernov, A. A.; [2002]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

This paper covers review of recent research on protein crystal properties, nucleation, growth and perfection. Mechanical properties of crystals built of molecules strongly exceeding the range of molecular forces are very different from conventional ones. Similar scaling is responsible for specificity of phase equilibrium for macromolecular systems of which thermodynamics is discussed. Nucleation and growth peculiarity and similarity in protein solutions as compared to inorganic solutions is addressed. Hypotheses on why and when microgravity (lack of convection) conditions may result in more perfect crystals are discussed.
Author
Protein Crystal Growth; Convection; Mechanical Properties; Nucleation; Thermodynamics; Crystals

20030062128 NASA Marshall Space Flight Center, Huntsville, AL, USA, Universities Space Research Association, Huntsville, AL, USA
Residual Gas in Closed Systems. III: Development and Reduction of Gases Generated by Source Materials
Palosz, W.; [2003]; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The amounts and composition of residual gases formed in sealed ampoules loaded with different sources (elements and II-VI and IV-VI compounds) after consecutive annealings were investigated. A given source was subjected to a series of heat treatments, with intermediate measurements and removal of the gas accumulated in the system. The results of these experiments are discussed in terms of the underlying thermochemical and kinetic phenomena and practical limitations of reducing the amount of residual gases in sealed ampoules.
Author
Residual Gas; Gas Composition; Reduction (Chemistry); Annealing; Heat Treatment

20030062291 Army Armament Research, Development and Engineering Center, Watervliet, NY
Application of Laser Pulse Heating to Simulate Thermomechanical Damage at Gun Bore Surfaces
Cote, Paul J.; Lee, Sabrina L.; Todaro, Mark E.; Kendall, Gay; Feb. 2003; 26 pp.; In English
Report No.(s): AD-A412012; ARCCB-TR-03002; No Copyright; Avail: CASI; A03, Hardcopy

Laser pulse heating experiments were performed to provide insights into the thermomechanical damage effects that occur at the surface of coated and uncoated gun steel under cyclic rapid heating and cooling. These effects include generation of a heat-affected zone severe plastic deformation, crack blunting, cavitation, fracture initiation, and generation of residual stresses. In addition, several of the deformation effects observed In the heat-affected zone indicate superplasticity. The results are compared with data from surfaces exposed to several different firing conditions to provide a basis for analyzing the specific role of the various degradation mechanisms. Supporting information Is provided from x-ray diffraction measurement of residual stresses in the steel heat-affected zones produced in a firing environment. The measured compressive stresses are explained using dilatometry data and are shown to be consistent with the observed damage processes.
DTIC
Thermodynamics; Cavities; Cavitation Flow; Gun Launchers

20030062826 University of Central Florida, Orlando, FL, USA
Nanoscale and Microscale Iron Emulsions for Treating DNAPL
Geiger, Cherie L.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 81-90; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This study demonstrated the feasibility of using emulsified nanoscale and microscale iron particles to enhance dehalogenation of (Dense Non-Aqueous Phase Liquid) DNAPL free-phase. The emulsified system consisted of a surfactant-stabilized, biodegradable oil-in-water emulsion with nanoscale or microscale iron particles contained within the emulsion droplets. It was demonstrated that DNAPLs, such as trichloroethene (TCE), diffuse through the oil membrane of the emulsion particle whereupon they reach an aqueous interior and the surface of an iron particle where dehalogenation takes place. The hydrocarbon reaction by-products of the dehalogenation reaction, primarily ethene (no chlorinated products detected), diffuse out of the emulsion droplet. This study also demonstrated that an iron-emulsion system could be delivered in-situ to the DNAPL pool in a soil matrix by using a simulated push well technique. Iron emulsions degraded pure TCE at a rate comparable to the degradation of dissolved phase TCE by iron particles, while pure iron had a very low degradation rate for free-phase TCE. The iron-emulsion systems can be injected into a sand matrix where they become immobilized and are not moved by flowing water. It has been documented that surfactant micelles possess the ability to pull pooled TCE into emulsion droplets where degradation of TCE takes place.
Author
Iron; Emulsions; Microparticles; Metal Particles; Liquid Phases

20030062842 NASA Langley Research Center, Hampton, VA, USA
National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology
Prior, Edwin J., Compiler; Jacobs, James A., Compiler; Chung, W. Richard, Compiler; May 2003; 568 pp.; In English; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology, October 13-16, 2002, San Jose, CA, USA; See also 20030062843 - 20030062888; Original contains black and white illustrations
Contract(s)/Grant(s): WU 772-30-10-32
Report No.(s): NASA/CP-2003-212403; L-18298; NAS 1.55:212403; No Copyright; Avail: CASI; A24, Hardcopy

This document contains a collection of experiments presented and demonstrated at the National Educators' Workshop: Update 2002 held in San Jose, California, October 13-16,2002. This publication provides experiments and demonstrations that can serve as a valuable guide to faculty who are interested in useful activities for their students. The material was the result of years of research aimed at better methods of teaching technical subjects. The experiments developed by faculty, scientists, and engineers throughout the USA and abroad add to the collection from past workshops. They include a blend of experiments on new materials and traditional materials.
Derived from text
Conferences; Education; Experiment Design; Materials Science

20030062863 Norfolk State Univ., VA, USA
The Rapid Collection and Analysis of Biocatalytic Data
Rowe, H. Alan; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 103-106; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The use of catalysts is an extremely important concept in chemical kinetics. However, it is often difficult to examine catalysis quantitatively in the laboratory setting. This exercise allows for the study of catalysts and kinetics in a setting that minimizes time spent on data collection and maximizes analysis and consideration of the data. A 2000 National Assessment of Educational Progress study in science has shown that science students improve their performance when using probes and computers to collect and analyze data. Reaction rates can be rapidly calculated and reaction orders inferred. Inhibitors of catalysts and catalytic response to variables of temperature, differing reactant concentration, etc. can be easily incorporated into the experiment.
Derived from text
Catalysts; Reaction Kinetics; Biochemistry; Polymers; Phenols

20030063130 NASA Ames Research Center, Moffett Field, CA, USA
CVD Growth of Carbon Nanotubes: Structure, Catalyst, and Growth
Delzeit, Lance; May 28, 2003; 40 pp.; In English; Girvan Venture Advisory Board Meeting, 28 May 2003
Contract(s)/Grant(s): 704-05-40; No Copyright; Avail: CASI; A03, Hardcopy

Carbon nanotubes (CNTs) exhibit extraordinary mechanical and unique electronic properties and hence have been

receiving much attention in recent years for their potential in nanoelectronics, field emission devices, scanning probes, high strength composites and many more applications. Catalytic decomposition of hydrocarbon feedstock with the aid of supported transition metal catalysts - also known as chemical vapor deposition (CVD) - has become popular to produce single-walled and multi-walled nanotubes (SWNTs, MWNTs) and multiwalled nanofibers (MWNFs). The ability to grow CNTs on patterned substrates and in vertically aligned arrays, and the simplicity of the process, has made CVD growth of CNTs an attractive approach.
Author
Carbon Nanotubes; Field Emission; Decomposition; Hydrocarbons; Vapor Deposition; Nanostructure Growth

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20030062090 NASA Glenn Research Center, Cleveland, OH, USA
Processing of Alumina-Toughened Zirconia Composites
Bansal, Narottam P.; Choi, Sung R.; May 2003; 16 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 708-87-07
Report No.(s): NASA/TM-2003-212451; E-13993; NAS 1.15:212451; Copyright; Avail: CASI; A03, Hardcopy

Dense and crack-free 10-mol%-yttria-stabilized zirconia (10YSZ)-alumina composites, containing 0 to 30 mol% of alumina, have been fabricated by hot pressing. Release of pressure before onset of cooling was crucial in obtaining crack-free material. Hot pressing at 1600 C resulted in the formation of ZrC by reaction of zirconia with grafoil. However, no such reaction was observed at 1500 C. Cubic zirconia and -alumina were the only phases detected from x-ray diffraction indicating no chemical reaction between the composite constituents during hot pressing. Microstructure of the composites was analyzed by scanning electron microscopy and transmission electron microscopy. Density and elastic modulus of the composites followed the rule-of-mixtures. Addition of alumina to 10YSZ resulted in lighter, stronger, and stiffer composites by decreasing density and increasing strength and elastic modulus.
Author
Aluminum Oxides; Yttria-Stabilized Zirconia; Fabrication; Mechanical Properties; Ceramics; Hot Pressing

20030062118 NASA Marshall Space Flight Center, Huntsville, AL, USA
Polymer Matrix Composites for Propulsion Systems
Nettles, Alan T.; [2003]; 2 pp.; In English; International Conference on Composites Engineering, 20-26 May 2003, New Orleans, LA, USA; No Copyright; Avail: CASI; A01, Hardcopy

The Access-to-Space study identified the requirement for lightweight structures to achieve orbit with a single-stage vehicle. Thus a task was undertaken to examine the use of polymer matrix composites for propulsion components. It was determined that the effort of this task would be to extend previous efforts with polymer matrix composite feedlines and demonstrate the feasibility of manufacturing large diameter feedlines with a complex shape and integral flanges, (i.e. all one piece with a 90 deg bend), and assess their performance under a cryogenic atmosphere.
Author
Polymer Matrix Composites; Feed Systems; Spacecraft Components; Leakage; Life (Durability); Engine Parts

20030062259 Boeing Co., USA
An Update on C458 AI-Li for Cryotanks
Babel, Henry W.; Rioja, Roberto; Jata, Kumar; [2003]; 16 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation provides an overview of ongoing research being conducted on C458 Al-Li composite cryotanks. Topics covered include: structural design of C458 Al-Li cryotanks, C458 ingot casting capability, C458 plate properties, summary of attained properties, design database capabilities, fatigue tests and testing, and ongoing research projects.
CASI
Aluminum Alloys; Lithium Alloys; Composite Materials; Structural Design; Cryogenic Fluid Storage; Storage Tanks; Fatigue (Materials)

20030062263 Boeing Co., Huntington Beach, CA, USA

Thermal-Mechanical Cyclic Test of a Composite Cryogenic Tank for Reusable Launch Vehicles

Messinger, Ross; Pulley, John; [2003]; 19 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structure, Structural Dynamics, & Material Conference, 7-10 Apr. 2003, Norfolk, VA, USA

Contract(s)/Grant(s): NCC8-39; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides an overview of thermal-mechanical cyclic tests conducted on a composite cryogenic tank designed for reusable launch vehicles. Topics covered include: a structural analysis of the composite cryogenic tank, a description of Marshall Space Flight Center's Cryogenic Structure Test Facility, cyclic test plans and accomplishments, burst test and analysis and post-testing evaluation.

CASI

Cryogenic Fluid Storage; Storage Tanks; Composite Materials; Destructive Tests; Cryogenic Fluids; Thermal Cycling Tests; Mechanical Properties

20030062265 Advanced Ceramics Research, Inc., Tucson, AZ, USA

Rapid Prototyping of Continuous Fiber Reinforced Ceramic Matrix Composites

Vaidyanathan, R.; Green, C.; Phillips, T.; Cipriani, R.; Yarlagadda, S.; Gillespie, J. W., Jr.; Effinger, M.; Cooper, K. C.; [2003]; 10 pp.; In English; SAMPE 2003 Symposium/Exhibition, 11-15 May 2003, Long Beach, CA, USA

Contract(s)/Grant(s): NAS8-00192; Copyright; Avail: CASI; A02, Hardcopy

For ceramics to be used as structural components in high temperature applications, their fracture toughness is improved by embedding continuous ceramic fibers. Ceramic matrix composite (CMC) materials allow increasing the overall operating temperature, raising the temperature safety margins, avoiding the need for cooling, and improving the damping capacity, while reducing the weight at the same time. They also need to be reliable and available in large quantities as well. In this paper, an innovative rapid prototyping technique to fabricate continuous fiber reinforced ceramic matrix composites is described. The process is simple, robust and will be widely applicable to a number of high temperature material systems. This technique was originally developed at the University of Delaware Center for Composite Materials (UD-CCM) for rapid fabrication of polymer matrix composites by a technique called automated tow placement or ATP. The results of mechanical properties and microstructural characterization are presented, together with examples of complex shapes and parts. It is believed that the process will be able to create complex shaped parts at an order of magnitude lower cost than current chemical vapor infiltration (CVI) and polymer impregnation and pyrolysis (PIP) processes.

Author

Ceramic Fibers; Ceramic Matrix Composites; Structural Design; Cooling; Fracture Strength

20030062301 Syracuse Univ., NY, USA

Assessment of a Crack Tip Element-Based Approach for Predicting Delamination Growth in Interlayer-Toughened Composite Skin-Stringer Panels

Rao, L. M.; Davidson, B. D.; December 2002; 102 pp.; In English

Report No.(s): AD-A412023; DOT/FAA/AR-02/102; No Copyright; Avail: CASI; A06, Hardcopy

A crack tip element approach to predict delamination growth is reviewed and then used to predict delamination growth in two stiffened-skin geometries that are typical of aircraft configurations. Predictions by this approach are then compared with experimental results. Test specimens were fabricated from T800H/ 3900-2, which is a graphite/epoxy material system toughened by a thermoplastic interlayer. Experiments were then performed, and predictions were compared to the observed results. Predictions that incorporated previously generated toughness data gave poor correlation to experiments. It was found that the fracture behavior of those specimens used to determine the toughness versus mode mix data was significantly different than that observed in the stiffened-skin elements. Specifically, the thermoplastic interlayer was relatively thin and dispersed in the interply regions of the skin-stringer elements, and delamination advance occurred through the low toughness base matrix and/or through the base resin/thermoplastic interlayer interface. Through scanning electron microscope observations, two distinct reasons were found to be the cause of lack of thermoplastic layer in the stiffened-skin specimens. The first of these is that the noncritical end of the delamination (i.e., away from the crack tip) terminated at a free surface that was reasonably close to the crack tip. This provided a path through which, during manufacture of the specimens, the toughening material could flow out of the inter-ply region. The second contributing factor was the relative angle of the plies bounding the delamination as compared to the direction of delamination advance. The fibers in these bounding plies compress the thermoplastic interlayer into a sinusoidal grid whose peaks and valleys are not aligned with the direction of crack growth.

DTIC

Crack Tips; Fracture Mechanics; Laminates

20030062780 Army Research Lab., Aberdeen Proving Ground, MD, USA

Characterization of Low Density Glass Filled Epoxies

Quesenberry, Matthew J.; Madison, Phillip H.; Jensen, Robert E.; Mar. 2003; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0001

Report No.(s): AD-A412137; ARL-TR-2938; No Copyright; Avail: CASI; A03, Hardcopy

This report discusses the experimental determination and modeling of several thermophysical and mechanical properties of glass filled epoxy composite systems for potential use as electronic potting compounds. Resin systems containing diglycidyl ether of bisphenol A epoxy, dicyandiamide curing agent, and 2-methylimidazole catalyst were produced with three different combinations of fillers: (1) solid glass spheres, (2) hollow glass spheres, and (3) mixed solid-hollow glass spheres. The density (p), coefficient of thermal expansion, and Young's modulus (E) of these different particulate filled composites were experimentally determined and modeled to elucidate the relationship between specific filler characteristics and resulting mechanical and thermophysical properties. The S-Combining Rule was found to correlate well with the experimental results for the solid glass sphere filled composites, but failed to accurately model ultimate composite properties when the hollow glass spherical filler was incorporated. The inaccuracy of micromechanical rules applied to the low-density composites was due to the minimal differences in modulus between the hollow spherical glass filler (Ef) and Em. However, reasonable micromechanical modulus approximations for the composites containing mixed hollow and solid spherical glass filler could be obtained.

DTIC

Glass; Mechanical Properties; Thermophysical Properties; Composite Materials; Potting Compounds; Epoxy Matrix Composites

20030062854 National Inst. of Standards and Technology, Gaithersburg, MD, USA

Wear of Advanced Ceramics

Jahanmir, Said; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 383-411; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation discusses mild to severe wear transition in advanced ceramics. Topics covered include: silicon nitride and silicon carbide characteristics, wear transition diagrams for aluminum alloys, silicon nitride and silicon carbide, reduction in wear of silicon nitride, damage formation, contact damage modes, critical load for onset of cone cracking, and transition loads.

CASI

Ceramics; Fatigue (Materials); Cracking (Fracturing); Loads (Forces); Aluminum Alloys; Silicon Carbides; Silicon Nitrides; Mechanical Properties

20030062876 Norfolk State Univ., VA, USA

Smart Material Actuators (2nd)

Song, Kyo D.; Yi, Won J.; Chu, Sang-Hyon; Golembiewski, Walter; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 333-340; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The concept of microwave-driven smart actuators is envisioned as the best option to alleviate the complexity associated with hard-wired power feed and control circuit. In addition to that, the simplicity of a microwave-driven actuator system can reduce a total weight and fabrication cost of the system. A proof of concept experiment using smart materials such as THUNDER (Thin Layer Composite Unimorph Ferroelectric Driver and Sensor) and paper actuators have been setup and demonstrated by using a microwave. Such advance system will produce a revolutionary class of smart devices that integrated sensors, actuators, and smart flight control as well as biologically-inspired systems.

Derived from text

Actuators; Microwaves; Smart Materials; Ferroelectricity; Sensors; Fabrication

20030062883 Southridge High School, Kennewick, WA, USA

Composites Approaching Neutral Density in Water

Bunnell, L. Roy; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and

Technology; May 2003, pp. 239-245; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

According to Archimedes, a solid object that displaces a volume of fluid with a weight exactly equal to the object's own weight is said to be neutrally buoyant in that fluid. Absolute neutral buoyancy is rarely if ever achieved, but the concept provides an interesting problem to be solved by the proper application of composite concepts. Loosely defined, a composite material is composed of at least two separate materials, combined to provide (generally mechanical) properties that are superior to those of the separate ingredients. By using two materials with appropriate densities, it should be possible to make a material with a bulk density approaching that of water. The lab described below provides some simple methods to produce such composites, and to measure how close their density is, at least in relative terms, to that of water.

Author

Buoyancy; Composite Materials; Neutral Buoyancy Simulation

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20030062076 NASA Marshall Space Flight Center, Huntsville, AL, USA

Sol-Gel Precursors for Ceramics from Minerals Simulating Soils from the Moon and Mars

Sibille, Laurent; Gavira-Gallardo, Jose-Antonio; Hourlier-Bahloul, Djamila; [2003]; 1 pp.; In English; 105th Annual Meeting of the American Ceramic Society, 27-30 Apr. 2003, Nashville, TN, USA

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

Recent NASA mission plans for the human exploration of our Solar System has set new priorities for research and development of technologies necessary to enable a long-term human presence on the Moon and Mars. The recovery and processing of metals and oxides from mineral sources on other planets is under study to enable use of ceramics, glasses and metals by explorer outposts. We report some preliminary results on the production of sol-gel precursors for ceramic products using mineral resources available in Martian or Lunar soil. The presence of SiO2, TiO2, and A12O3 in both Martian (44 wt.% SiO2, 1 wt.% TiO2, 7 wt.% Al2O3) and Lunar (48 wt.% SiO2, 1.5 wt.% TiO2, 16 wt.% Al2O3) soils and the recent developments in chemical processes to solubilize silicates using organic reagents and relatively little energy indicate that such an endeavor is possible. In order to eliminate the risks involved in the use of hydrofluoric acid to dissolve silicates, two distinct chemical routes are investigated to obtain soluble silicon oxide precursors from Lunar and Martian simulant soils. Clear sol-gel precursors have been obtained by dissolution of silica from Lunar simulant soil in basic ethylene glycol (C2H4(OH)2) solutions to form silicon glycolates. Thermogravimetric Analysis and X-ray Photoelectron Spectroscopy were used to characterize the elemental composition and structure of the precursor molecules. Further concentration and hydrolysis of the products was performed to obtain gel materials for evaluation as ceramic precursors. In the second set of experiments, we used the same starting materials to synthesize silicate esters in acidified alcohol mixtures. Preliminary results indicate the presence of silicon alkoxides in the product of distillation.

Author

Sol-Gel Processes; Ceramics; Aluminum Oxides; Silicon Oxides; Titanium Oxides; Chemical Reactions; Chemical Composition; Soils; Chemical Analysis

20030062163 Utah Univ., Salt Lake City, UT, USA

Simulation of Combustion Systems with Realistic g-jitter

Mell, William E.; McGrattan, Kevin B.; Baum, Howard R.; [2003]; 26 pp.; In English

Contract(s)/Grant(s): NAG3-2403; Copyright; Avail: CASI; A03, Hardcopy

In this project a transient, fully three-dimensional computer simulation code was developed to simulate the effects of realistic g-jitter on a number of combustion systems. The simulation code is capable of simulating flame spread on a solid and nonpremixed or premixed gaseous combustion in nonturbulent flow with simple combustion models. Simple combustion models were used to preserve computational efficiency since this is meant to be an engineering code. Also, the use of sophisticated turbulence models was not pursued (a simple Smagorinsky type model can be implemented if deemed appropriate) because if flow velocities are large enough for turbulence to develop in a reduced gravity combustion scenario it is unlikely that g-jitter disturbances (in NASA's reduced gravity facilities) will play an important role in the flame dynamics.

Acceleration disturbances of realistic orientation, magnitude, and time dependence can be easily included in the simulation. The simulation algorithm was based on techniques used in an existing large eddy simulation code which has successfully simulated fire dynamics in complex domains. A series of simulations with measured and predicted acceleration disturbances on the International Space Station (ISS) are presented. The results of this series of simulations suggested a passive isolation system and appropriate scheduling of crew activity would provide a sufficiently 'quiet' acceleration environment for spherical diffusion flames.
Derived from text
Computerized Simulation; Vibration; Microgravity; Combustion Physics; Acceleration (Physics); Mathematical Models

20030062201 NASA Marshall Space Flight Center, Huntsville, AL, USA
Residual Gas in Closed Systems, 2, Formation of Gases from the Source Materials
Palosz, W.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The amount and composition of residual gases formed in sealed ampoules loaded with different elements or binary II-VI or IV-VI compounds were investigated. The source materials underwent different thermal processings, annealing and/or resublimation conducted under different conditions. The results of these experiments are discussed in terms of the procedural, thermochemical, and kinetic limitations to the process.
Author
Residual Gas; Ampoules; Oxides; Impurities; Gas Composition

20030062297 California Univ., Irvine, CA
Nonlinear Distortion and Disintegration of Conical Liquid Sheets at High Pressure
Sirignano, William A.; Mehring, Carsten; Mar. 7, 2003; 218 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0204
Report No.(s): AD-A412019; ARO-39509.6-EN; No Copyright; Avail: CASI; A10, Hardcopy

The research has identified, characterized, and quantified various important domains of behavior in the nonlinear distortion and disintegration of injected liquid fuel streams. Various liquid-stream configurations resulting from fuel injectors have been analyzed: conical, annular and planar streams with and without swirl; twin-fluid and single-fluid atomizers. Linear and nonlinear theories of distortion and disintegration have been developed and have predicted initial stream break-up characteristics. Distinct regimes of ligament break-up and cellular break-up have been determined. Modulations of both liquid streams and gas streams have been studied as means of active control. The characteristics of two-dimensional capillary wave phenomena have been determined. The effects of impacting gas jets have been compared with the Kelvin-Helmholtz effect of parallel jets. Pulsed gas jets have been shown to be more effective than gas jets as a break-up mechanism. The importance of the rate of forced stretching of the liquid stream compared to the rate of disturbance propagation in the stream (i.e., capillary wave velocity or characteristic viscous velocity) has been quantified; various regimes for the forced stretching have been identified and characterized.
DTIC
Liquids; High Pressure; Sheets; Distortion; Fuel Injection

20030062831 Florida Inst. of Tech., FL, USA
An Investigation of the Reverse Water Gas Shift Process and Operating Alternatives
Whitlow, Jonathan E.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 157-166; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Reverse Water Gas Shift (RWGS) process can produce water and ultimately oxygen through electrolysis. This technology is being investigated for possible use in the exploration of Mars as well as a potential process to aid in the regeneration of oxygen from carbon dioxide. The initial part of this report summarizes the results obtained from operation of the RWGS process at Kennedy Space Center during May and June of this year. It has been demonstrated that close to complete conversion can be achieved with the RWGS process under certain operating conditions. The report also presents results obtained through simulation for an alternative staged configuration for RWGS which eliminates the recycle compressor. This configuration looks promising and hence seems worthy of experimental investigation.
Author
Carbon Dioxide; Systems Engineering; Gas Flow; Technology Utilization; Manned Mars Missions; Water

20030062839 Sierra Engineering, Inc., Carson City, NV, USA
Swirl Coaxial Injector Development, Part 2, CFD Modeling
Cheng, G. C.; Johnson, C. W.; Cohn, R. K.; Mar. 22, 2002; 13 pp.; In English
Contract(s)/Grant(s): F04611-01-C-0010; Proj-BMDO
Report No.(s): AD-A412040; AFRL-PR-ED-TP-2002-066; No Copyright; Avail: CASI; A03, Hardcopy

Injector design is critical to obtaining the dual goals of long engine life as well as providing high energy release efficiency in the main combustion chamber. Introducing a swirl component in the injector flow can enhance the propellant mixing and thus improve engine performance. A combined experimental and computational effort is underway to examine the properties of GOX-centered, swirl coaxial injectors to examine their performance and lifetime characteristics. These injectors can be easily manufactured and can be designed to maintain a low face temperature, which will improve engine life. Therefore, swirl coaxial injectors, which swirl liquid fuel around a gaseous oxygen core, show promise for the next generation of high performance staged combustion rocket engines utilizing hydrocarbon fuels. The purpose of this work is to not only examine the properties of these injectors, but also to develop a design methodology, utilizing a combination of high-pressure cold-flow testing, uni-element hot- fire testing, and computations to create a high performing, long life swirl coaxial injector for multi-element combustor use.
DTIC
Combustion; Reliability Engineering

20030062899 Denver Univ., Denver, CO
Physical Chemistry of Energetic Nitrogen Compounds
Coombe, Robert D.; Feb. 28, 2003; 24 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0062; AF Proj. 2303
Report No.(s): AD-A411654; AFRL-SR-AR-TR-03-0080; No Copyright; Avail: CASI; A03, Hardcopy

Photolysis of nitrogen trichloride at 193 nm efficiently produces the excited singlet delta state of NC1, a species useful as an energy carrier in atomic iodine lasers. Photolysis of mixtures of nitrogen trichloride with molecular iodides at 193 nm produces strong emission at 1315 nm from excited iodine atoms. Rate constants for the collisional quenching of excited singlet delta NC1 and excited iodine atoms by nitrogen trichloride were determined at room temperature. In a second part of the research, the deposition of BN films from the dissociation of boron triazide was investigated using plasma-assisted deposition methods. These experiments produced stable, dense, and adherent BN films with good chemical characteristics. The films were found to be amorphous, though, a result thought to be associated with self-assembly of boron triazide dissociation fragments into PN nanoparticles in the gas phase. This hypothesis was supported by IR analysis of the constituents of a boron triazide/argon plasma trapped in a low temperature matrix.
DTIC
Iodine Lasers; Nitrogen Compounds; Physical Chemistry; Chemical Properties

20030062930 Kansas State Univ., Manhattan, KS
AB Initio Propagator Theory of Clusters
Ortiz, J. V.; Feb. 12, 2003; 15 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0185; Proj-3484
Report No.(s): AD-A411554; AFRL-SR-AR-TR-03-0047; No Copyright; Avail: CASI; A03, Hardcopy

Oxidative processes involving aluminum lead to the creation of many intermediates whose structure and reactivity stimulate intense study. Aluminum-rich species are especially pertinent to the growth and structure of interfaces between bulk Al2O3 and metallic Al phases. Ceramics, minerals, reactive surfaces and catalytic supports often consist of oxides of aluminum. This project aims to improve understanding of the basic interactions between atoms of oxygen and aluminum at the atomic level. Quantum mechanical calculations on the structure and energetics of aluminum-oxygen clusters have been performed with methods that have predictive value for precise, spectroscopic experiments. The mathematical structure of the electron structure methods employed also allows for qualitative interpretations in terms of the language of one-electron theory which nonetheless retain a rigorous connection to the correlated, ab initio theory that underlies the calculations. Methodological advances that allow consideration of larger and more complex clusters have been developed as well.
DTIC
Quantum Theory; Aluminum Oxides; Atomic Structure; Quantum Mechanics; Clusters

20030062936 Gordon Research Conferences, Inc., Kingston, RI
2001 Gordon Research Conference on Molecular Energy Transfer
Storm, Carlyle B.; Jan. 2001; 14 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0340; Proj-2303
Report No.(s): AD-A411956; AFRL-SR-AR-TR-03-0061; No Copyright; Avail: CASI; A03, Hardcopy

The Gordon Research Conference (GRC) on Molecular Energy Transfer was held at Harbortown Resort, Ventura, California January 14-19, 2001. The conference was well attended with 89 participants (list enclosed). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both US and foreign scientists, senior researchers, young investigators, and students. In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled. In addition to these formal interactions, 'free time' was scheduled to allow informal discussions. Such, discussions are fostering new collaborations and joint efforts in the field (program enclosed).
DTIC
Energy Transfer; Particle Collisions; Molecular Dynamics; Conferences

20030062978 NASA Marshall Space Flight Center, Huntsville, AL, USA
RNA Crystallization
Golden, Barbara L.; Kundrot, Craig E.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

RNA molecules may be crystallized using variations of the methods developed for protein crystallography. As the technology has become available to syntheisize and purify RNA molecules in the quantities and with the quality that is required for crystallography, the field of RNA structure has exploded. The first consideration when crystallizing an RNA is the sequence, which may be varied in a rational way to enhance crystallizability or prevent formation of alternate structures. Once a sequence has been designed, the RNA may be synthesized chemically by solid-state synthesis, or it may be produced enzymatically using RNA polymerase and an appropriate DNA template. Purification of milligram quantities of RNA can be accomplished by HPLC or gel electrophoresis. As with proteins, crystallization of RNA is usually accomplished by vapor diffusion techniques. There are several considerations that are either unique to RNA crystallization or more important for RNA crystallization. Techniques for design, synthesis, purification, and crystallization of RNAs will be reviewed here.
Author
Ribonucleic Acids; Crystallization; Purification; Electrophoresis; Crystallography

20030063173 Air Force Research Lab., Edwards AFB, CA, USA
Research in Ionic Liquids
Drake, Greg; Hawkins, Tom; Hall, Leslie; Brand, Adam; McKay, Milton; Mar. 12, 2003; 38 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A411634; AFRL-PR-ED-VG-2003-066; No Copyright; Avail: CASI; A03, Hardcopy

Ionic liquids is one of the focal points for HEDM research. HEDM research effort has shifted away from cryogenic/matrix isolation and now is pointing into synthetic endeavors. Ionic liquids have been around a very long time (100 years) , and recently they have really taken off. But in this 'take off' most researchers are looking for applications in the use of ionic liquids. Few people are looking at ionic liquids for the 'why' these materials are low melting and how this unusual class of compounds might be more useful for other applications
DTIC
Cryogenics; Aluminum Compounds

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METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20030062018 NASA Marshall Space Flight Center, Huntsville, AL, USA
Selection And Evaluation Of An Alloy For Nozzle Application
Pandey, A. B.; Shah, S.; Shadoan, M.; Lyles, Garry, Technical Monitor; [2003]; 1 pp.; In English; AeroMet 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: Other Sources; Abstract Only

The present work includes results on material characterization conducted under COBRA Hydrogen Cooled Nozzle Program and was funded by NASA MSFC. The nozzle requires a material that has high strength at ambient and high (up to l200 F) temperatures in air and hydrogen. Presently, a precipitation hardened steel; A-286 is used in nozzles for Space Shuttle Engines. The A-286 alloy has limited hydrogen compatibility and weldability. The present work focused on selection and characterization of JBK-75 alloy that has significantly higher capability in hydrogen and weldability in addition to other attributes. The alloy was evaluated at different temperatures and environments. Tungsten Inert Gas (TIG) and Electron Beam welding techniques were used to evaluate the weldability of material. Brazing was also conducted on the alloy and evaluated. The characterization of base JBK-75 alloy, welded and brazed alloy included tensile properties, low cycle fatigue and crack growth resistance at different temperatures in air and hydrogen environments. The results indicated that JBK-75 has excellent tensile and fatigue properties in air and hydrogen. The welded and brazed alloy also showed very good properties.
Author
Nozzle Design; Weldability; Alloys; Fatigue (Materials); Fracture Strength; Tensile Properties

20030062087 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Stir Welding: A New Solid State Welding Process
Ding, R. Jeffrey; [2003]; 1 pp.; In English; National Design and Engineering Show, 3-7 Mar. 2003, Chicago, IL, USA; No Copyright; Avail: Other Sources; Abstract Only

Thermal stir welding is a new welding process developed at NASA's Marshall Space Flight Center in Huntsville, AL. Thermal stir welding is similar to friction stir welding in that it joins similar or dissimilar materials without melting the parent material. However, unlike friction stir welding, the heating, stirring and forging elements of the process are all independent of each other and are separately controlled. Furthermore, the heating element of the process can be either a solid-state process (such as a thermal blanket, induction type process, etc), or, a fusion process (YG laser, plasma torch, etc.) The separation of the heating, stirring, forging elements of the process allows more degrees of freedom for greater process control. This paper introduces the mechanics of the thermal stir welding process. In addition, weld mechanical property data is presented for selected alloys as well as metallurgical analysis.
Author
Welding; Degrees Of Freedom; Laser Plasmas; Friction Stir Welding; Stirring

20030062124 NASA Marshall Space Flight Center, Huntsville, AL, USA
Composition Dependence of the Hydrostatic Pressure Coefficients of the Bandgap of ZnSe(1-x)Te(x) Alloys
Wu, J.; Yu, K. M.; Walukiewicz, W.; Shan, W.; Ager, J. W., III; Haller, E. E.; Miotkowski, I.; Ramdas, A. K.; Su, Ching-Hua; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Optical absorption experiments have been performed using diamond anvil cells to measure the hydrostatic pressure dependence of the fundamental bandgap of ZnSe(sub 1-xTe(sub x) alloys over the entire composition range. The first and second-order pressure coefficients are obtained as a function of composition. Starting from the ZnSe side, the magnitude of both coefficients increases slowly until x approx. 0.7, where the ambient-pressure bandgap reaches a minimum. For larger values of x the coefficients rapidly approach the values of ZnTe. The large deviations of the pressure coefficients from the linear interpolation between ZnSe and ZnTe are explained in terms of the band anticrossing model.
Author
Zinc Tellurides; Dependence; Hydrostatic Pressure; Energy Gaps (Solid State); Selenium Alloys; Chemical Composition

20030062125 Boeing Co., USA
An Update on C458 Al-Li
Babel, Hank; Rioja, Robert; [2003]; 1 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA
Contract(s)/Grant(s): NAS8-01099; No Copyright; Avail: Other Sources; Abstract Only

The 1.8 Li content and consequently the 0.0945 lb.cu in density of C458 along with its higher modulus and good strength and toughness at ambient and cryogenic temperatures made it an attractive alloy for single and multiple use cryogenic tankage and unpressurized structure for space launch and operational vehicles. A major effort during the past year was directed towards establishing a production capability for C458 plate. Alcoa established a production ingot casting capability under Air Force Research Laboratory and NASA's Space Launch Initiative (SLI) sponsorship. Three heat lots of material were rolled so that the criterion for S-basis allowables could be met for AMS specifications. Lot acceptance testing showed that the strength and toughness values equaled and exceeded those obtained under the earlier Air Force Program when the alloy was developed. The details of this effort and the results achieved will be described. During the testing of compact tension specimens, particularly

at cryogenic temperatures, delaminations were noted on the fractured surface. An investigation was initiated to better understand this condition. The results of this investigation will be presented which includes some of the successful production application of alloys with and without Li that exhibit this type of behavior.
Author
Cryogenic Fluid Storage; Cryogenic Rocket Propellants; Tanks (Containers); Aluminum-Lithium Alloys

20030062179 Boeing Co., USA
Aging Optimization of Aluminum-Lithium Alloy C458 for Application to Cryotank Structures
Sova, B. J.; Sankaran, K. K.; Babel, H.; Farahmand, B.; Rioja, R.; [2003]; 2 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA
Contract(s)/Grant(s): NAS8-01099; Copyright; Avail: Other Sources; Abstract Only

Compared with aluminum alloys such as 2219, which is widely used in space vehicle for cryogenic tanks and unpressurized structures, aluminum-lithium alloys possess attractive combinations of lower density and higher modulus along with comparable mechanical properties. These characteristics have resulted in the successful use of the aluminum-lithium alloy 2195 (Al-1.0 Li-4.0 Cu-0.4 Mg-0.4 Ag-0.12 Zr) for the Space Shuttle External Tank, and the consideration of newer U.S. aluminum-lithium alloys such as L277 and C458 for future space vehicles. These newer alloys generally have lithium content less than 2 wt. % and their composition and processing have been carefully tailored to increase the toughness and reduce the mechanical property anisotropy of the earlier generation alloys such 2090 and 8090. Alloy processing, particularly the aging treatment, has a significant influence on the strength-toughness combinations and their dependence on service environments for aluminum-lithium alloys. Work at NASA Marshall Space Flight Center on alloy 2195 has shown that the cryogenic toughness can be improved by employing a two-step aging process. This is accomplished by aging at a lower temperature in the first step to suppress nucleation of the strengthening precipitate at sub-grain boundaries while promoting nucleation in the interior of the grains. Second step aging at the normal aging temperature results in precipitate growth to the optimum size. A design of experiments aging study was conducted for plate. To achieve the T8 temper, Alloy C458 (Al-1.8 Li-2.7 Cu-0.3 Mg-0.08 Zr-0.3 Mn-0.6 Zn) is typically aged at 300F for 24hours. In this study, a two-step aging treatment was developed through a comprehensive 2(exp 4) full factorial design of experiments study and the typical one-step aging used as a reference. Based on the higher lithium content of C458 compared with 2195, the first step aging temperature was varied between 175F and 250F. The second step aging temperatures was varied between 275F and 325F, which is in the range of the single-step aging temperature. The results of the design of experiments used for the T8 temper as well as a smaller set of experiments for the T6 temper will be presented. The process of selecting the optimum aging treatment, based on the measured mechanical properties at room and cryogenic temperature as well as the observed deformation mechanisms, will be presented in detail. The implications for the use of alloy C458 in cryotanks will be discussed.
Author
Aluminum-Lithium Alloys; Aging (Metallurgy); Hardening (Materials); Cryogenic Fluid Storage; Storage Tanks; Mechanical Properties; Optimization

20030062181 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Connection Between Local Icosahedral Order in Metallic Liquids and the Nucleation Behavior of Ordered Phases
Kelton, K. F.; Gangopadhyay, A. K.; Lee, G. W.; Hyers, R. W.; Rathz, T. J.; Rogers, J. R.; Robinson, M. B.; Schenk, T.; Simonet, V.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Over fifty years ago, David Turnbull showed that the temperature of many metallic liquids could be decreased far below their equilibrium melting temperature before crystallization occurred. To explain those surprising results, Charles Frank hypothesized that the local structures of undercooled metallic liquids are different from those of crystal phases, containing a significant degree of icosahedral order that is incompatible with extended periodicity. Such structural differences must create a barrier to the formation crystal phases, explaining the observed undercooling behavior. If true, the nucleation from the liquid of phases with extended icosahedral order should be easier. Icosahedral order is often favored in small clusters, as observed recently in liquid-like clusters of pure Pb on the (111) surface of Si[3], for example. However, it has never been shown that an increasing preference for icosahedral phase formation can be directly linked with the development of icosahedral order in the undercooled liquid. Owing to the combination of very recent advances in levitation techniques and the availability of synchrotron x-ray and high flux neutron facilities, this is shown here.
Author
Supercooling; Liquid Metals; Crystal Structure

20030062197 NASA Marshall Space Flight Center, Huntsville, AL, USA, Mississippi State Univ., Mississippi State, MS, USA

Thermo-Mechanical Processing in Friction Stir Welds

Schneider, J. A.; Nunes, A. C., Jr.; [2002]; 11 pp.; In English; TMS (The Mineral, Metals, and Materials Society) 2003, 132nd Annual Meeting and Exhibition, 2-6 Mar. 2003, San Diego, CA, USA; Copyright; Avail: CASI; A03, Hardcopy

In Friction Stir Welding (FSW) a rotating pin-tool inserted into a weld seam literally stirs the edges of the seam together. In this study, two flow paths are proposed that define the FWS zone. Studies using a longitudinal tungsten wire (0.0025 dia.) were used to visualize and document the material flow. The material flow path is described using a mathematical model. Author

Friction Stir Welding; Welded Joints; Seams (Joints)

20030062818 California Polytechnic State Univ., San Luis Obispo, CA, USA

Corrosion Activities at the NASA Kennedy Space Center

Heidersbach, Robert H.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 101-108; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This report documents summer faculty fellow efforts in the corrosion test bed at the NASA Kennedy Space Center. During the summer of 2002 efforts were concentrated on three activities: a short course on corrosion control for KSC personnel, evaluation of commercial wash additives used for corrosion control on Army aircraft, and improvements in the testing of a new cathodic protection system under development at KSC.

Author

Corrosion Tests; NASA Programs; Concrete Structures; Aircraft Industry

20030062845 California Polytechnic State Univ., San Luis Obispo, CA, USA

Metallic Glass: Driving Far From Equilibrium and Returning Back

Chen, Katherine C.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 117-122; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Incorporation of metallic glass (or 'metglass') into a sophomore-level Structures of Materials Laboratory has allowed the illustration of several different concepts in Materials Science and Engineering. The structural differences between crystalline and noncrystalline materials are defined and observed experimentally through x-ray diffraction (XRD). Special fabrication techniques (e.g., rapid solidification by melt spinning, or lattice frustration) are first explored to explain how processing results in nonequilibrium or metastable structures. Thermodynamics and kinetics are invoked to help frame the situation and also to help predict structural changes upon heating. Annealing treatments are then performed to confirm predictions. Further exploration of metallic glass or of processing treatments far from equilibrium can then be made.

Derived from text

Metallic Glasses; Crystallinity; Equilibrium; Thermodynamics; Fabrication; Kinetics

20030062857 ASM International Foundation, Materials Park, OH, USA

Educational Outreach Program Summary

Hayes, Charles R.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 495-497; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

ASM International Foundation provides for the advancement of scientific and engineering knowledge through its support of education and research. An educational outreach program summary is presented. The topics include: 1) Materials Camp; 2) K-12 Teachers; 3) College; and 4) Science Fairs.

CASI

Education; Metals; Materials Science

20030062869 California Polytechnic State Univ., San Luis Obispo, CA, USA

Discovering the Source of Properties in Alloys: Metallographic Examination

Niebuhr, David V.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 437-456; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a laboratory exercise on how microstructures determine the physical and mechanical properties of metals. Common engineering structures are used to show how materials are relevant and important to everyday life. 'Structure determines properties,' is a common saying in the introductory course in materials engineering. Students are introduced to the idea that all materials have a microstructure and that these structures can be simple or very complex. The goal of this experiment is to observe common engineering materials and to deduce the properties that are a result of the microstructures. Using the light microscope, 11 metallic samples are observed. Each sample has been polished and etched (with a chemical) to make its microstructure observable. The characterization of different materials can be determined by just looking at the microstructure. After the observation of these materials and using a newfound knowledge of materials and engineering, and some deductive reasoning, students are presented with a question and answer sheet to test their understanding of the microstructure of alloys.
CASI
Mechanical Properties; Metallography; Microstructure; Microscopy; Cast Alloys

20030062886 California Univ., Davis, CA, USA
Oxygen Diffusion into Titanium
Meier, Mike L.; Broumas, Aaron; Degnan, Nick; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 457-467; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This experiment involves determining the activation energy and diffusion rate of oxygen into titanium from a series of microhardness profiles. Several aspects presented in materials science courses are ultimately covered in this experiment, three of which are high-temperature oxidation, diffusion, and solid-solution hardening. The goal of this experiment is to provide upperdivision materials science laboratory courses with a relatively inexpensive procedure for measuring the diffusivity coefficients and activation energies while emphasizing fundamental issues of materials science.
Derived from text
Diffusion; Oxygen; Titanium; Activation Energy; Microhardness; Materials Science

20030062901 Northwestern Univ., Evanston, IL
Bonding, Energetics and Mechanical Properties of Intermetallics
Freeman, Arthur J.; Gornostyrev, Yu N.; Mryasov, O. N.; Kontsevoi, O. Y.; Medvedeva, N. I.; Jun. 2001; 10 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0321
Report No.(s): AD-A411651; AFRL-SR-AR-TR-03-0067; No Copyright; Avail: CASI; A02, Hardcopy

To fulfill the great potential of intermetallic alloys for use in high temperature structural applications, it is necessary to understand on the microscopic level the mechanisms controlling their mechanical behavior, including such key phenomena as dislocation structure and mobility, crack blunting and propagation, the role and the effect of alloying additions: while they have been characterized by mesoscopic length and energy scales, they are determined on the microscopic level by the electronic structure.
DTIC
Alloys; Alloying; Structural Design; Crack Propagation; Intermetallics

20030062977 Ufa State Technical Aviation Univ., Russia
Bulk Nanostructured Refractory Metals with Enhanced Mechanical Properties Produced by Equal Channel Angular Pressing
Valiev, R. Z.; Alexandrov, I. V.; Dec. 11, 2002; 6 pp.; In English
Contract(s)/Grant(s): N62558-02-M-6024
Report No.(s): AD-A411681; R/D-9362-AN-01; No Copyright; Avail: CASI; A02, Hardcopy

The air of the present project is to obtain a set of bulk billets 100 mm long with UFG structure made of refractory metals such as tungsten and tantalum. The previous positive experience of refining the tungsten's structure using equal channel angular pressing (ECAP) was taken into account. For the production of bulk billets with UFG structure having a more long-lengthed size than those obtained in earlier works, it has been necessary to introduce modifications into the die-set being used and to carry out updating of the whole die-set for ECAP. That is why the main objective of the first stage was to find a new approach to the modernization of pressing process, to design and manufacture a new die set and to test its work, using relatively long billets made of hard-to-deform refractory metals.
DTIC
Mechanical Properties; Nanostructures (Devices); Refractory Metals; Pressing (Forming); Metallurgy

20030062985 United Engineering Foundation, Inc., New York, NY, USA

International Alloy Conference (Third) (IAC-3). An Interdisciplinary Approach to the Science of Alloys in Metals, Minerals and Other Materials Systems Held in Estoril/Cascais, Portugal on June 30-July 5, 2002

Gonis, G.; Meike, A.; Turchi, P. E.; Rajan, K.; Jan. 8, 2003; 44 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0267

Report No.(s): AD-A411477; AFRL-SR-AR-TR-03-0038; No Copyright; Avail: CASI; A03, Hardcopy

Research on inorganic materials is facilitated by identifying the common features such as theoretical treatments of structure-property relationships and experimental techniques applicable to a wide range of materials. This conference he disseminate knowledge of such approaches and to inform scientists of common problems and interests.

DTIC

Metals; Alloys; Minerals; Inorganic Materials

20030063110 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of a Novel Discontinuously Reinforced Aluminum for Space Applications

Pandey, Awadh; Shah, Sandeep; Shadoan, Mike; May 22, 2003; 22 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: CASI; A03, Hardcopy

The present results indicated that: Al-Sc-Mg-X alloys were selected to provide higher strength from -423 to 450F. SiC and B4C were chosen as reinforcements. Fine spherical powder of Al-Sc-Mg-X was produced using helium gas atomization. Matrix alloy and DRA were processed using vacuum hot processing and extrusion. DRA showed very high strength 100ksi at cryo, RT and hydrogen. Ductility was low. Matrix alloy exhibited high strength and ductility. LCF of matrix was higher than DRA in high strain range.

Derived from text

Aluminum Alloys; Product Development; Technology Utilization; High Strength

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20030062083 NASA Marshall Space Flight Center, Huntsville, AL, USA

Investigation of the Surface Stress in SiC and Diamond Nanocrystals by In-situ High Pressure Powder Diffraction Technique

Palosz, B.; Stelmakh, S.; Grzanka, E.; Gierlotka, S.; Zhao, Y.; Palosz, W.; [2003]; 1 pp.; In English; Materials Research Society Spring Meeting, 21-25 Apr. 2003, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The real atomic structure of nanocrystals determines key properties of the materials. For such materials the serious experimental problem lies in obtaining sufficiently accurate measurements of the structural parameters of the crystals, since very small crystals constitute rather a two-phase than a uniform crystallographic phase system. As a result, elastic properties of nanograins may be expected to reflect a dual nature of their structure, with a corresponding set of different elastic property parameters. We studied those properties by in-situ high-pressure powder diffraction technique. For nanocrystalline, even one-phase materials such measurements are particularly difficult to make since determination of the lattice parameters of very small crystals presents a challenge due to inherent limitations of standard elaboration of powder diffractograms. In this investigation we used our methodology of the structural analysis, the 'apparent lattice parameter' (alp) concept. The methodology allowed us to avoid the traps (if applied to nanocrystals) of standard powder diffraction evaluation techniques. The experiments were performed for nanocrystalline Sic and GaN powders using synchrotron sources. We applied both hydrostatic and isostatic pressures in the range of up to 40 GPa. Elastic properties of the samples were examined based on the measurements of a change of the lattice parameters with pressure. The results show a dual nature of the mechanical properties (compressibilities) of the materials, indicating a complex, core-shell structure of the grains.

Author

Atomic Structure; Nanocrystals; Crystallography; Lattice Parameters; Elastic Properties; Diffraction

20030062169 NASA Marshall Space Flight Center, Huntsville, AL, USA

X-Ray Diffraction and Imaging Study of Imperfections of Crystallized Lysozyme with Coherent X-Rays

Hu, Zheng-Wei; Chu, Y. S.; Lai, B.; Cai, Z.; Thomas, B. R.; Chernov, A. A.; [2003]; 1 pp.; In English

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Phase-sensitive x-ray diffraction imaging and high angular-resolution diffraction combined with phase contrast radiographic imaging are employed to characterize defects and perfection of a uniformly grown tetragonal lysozyme crystal in symmetric Laue case. The fill width at half-maximum (FWHM) of a 4 4 0 rocking curve measured from the original crystal is approximately 16.7 arcseconds, and defects, which include point defects, line defects, and microscopic domains, have been clearly observed in the diffraction images of the crystal. The observed line defects carry distinct dislocation features running approximately along the <110> growth front, and they have been found to originate mostly at a central growth area and occasionally at outer growth regions. Individual point defects trapped at a crystal nucleus are resolved in the images of high sensitivity to defects. Slow dehydration has led to the broadening of the 4 4 0 rocking curve by a factor of approximately 2.4. A significant change of the defect structure and configuration with drying has been revealed, which suggests the dehydration induced migration and evolution of dislocations and lattice rearrangements to reduce overall strain energy. The sufficient details of the observed defects shed light upon perfection, nucleation and growth, and properties of protein crystals.

Author

X Ray Diffraction; Imaging Techniques; Lysozyme; Crystallization; Crystal Defects; Crystal Structure

20030062178 NASA Marshall Space Flight Center, Huntsville, AL, USA, Universities Space Research Association, Huntsville, AL, USA

Elasticity and Strength of Biomacromolecular Crystals: Lysozyme

Holmes, A. M.; Witherow, W. K.; Chen, L. Q.; Chernov, A. A.; [2003]; 1 pp.; In English

Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Other Sources; Abstract Only

The static Young modulus, E = 0.1 to 0.5 GPa, the crystal critical strength (sigma(sub c)) and its ratio to E,sigma(sub c)/E is approximately 10(exp 3), were measured for the first time for non cross-linked lysozyme crystals in solution. By using a triple point bending apparatus, we also demonstrated that the crystals were purely elastic. Softness of protein crystals built of hard macromolecules (26 GPa for lysozyme) is explained by the large size of the macromolecules as compared to the range of intermolecular forces and by the weakness of intermolecular bonds as compared to the peptide bond strength. The relatively large reported dynamic elastic moduli (approximately 8 GPa) from resonance light scattering should come from averaging over the moduli of intracrystalline water and intra- and intermolecular bonding.

Author

Lysozyme; Macromolecules; Elastic Properties; Modulus Of Elasticity; Crystals; Hardness; Mechanical Properties; Intermolecular Forces

20030062862 NASA Ames Research Center, Moffett Field, CA, USA

Nanotechnology: Opportunities and Challenges

Meyyappan, Meyya; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 1-59; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A04, Hardcopy

Nanotechnology seeks to exploit novel physical, chemical, biological, mechanical, electrical, and other properties, which arise primarily due to the nanoscale nature of certain materials. A key example is carbon nanotubes (CNTs) which exhibit unique electrical and extraordinary mechanical properties and offer remarkable potential for revolutionary applications in electronics devices, computing, and data storage technology, sensors, composites, nanoelectromechanical systems (NEMS), and as tip in scanning probe microscopy (SPM) for imaging and nanolithography. Thus the CNT synthesis, characterization, and applications touch upon all disciplines of science and engineering. This presentation will provide an overview and progress report on this and other major research candidates in Nanotechnology and address opportunities and challenges ahead.

Author

Carbon Nanotubes; Nanofabrication; Nanotechnology; Technology Assessment

20030063042 ATK-Thiokol Propulsion, Brigham City, UT, USA

Improved Multi-Axial, Temperature and Time Dependent (MATT) Failure Model

Richardson, D. E.; Anderson, G. L.; Macon, D. J.; [2002]; 5 pp.; In English; 26th Annual Meeting of The Adhesion Society, 23-26 Feb. 2003, Myrtle Beach,SC, USA

Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: CASI; A01, Hardcopy

An extensive effort has recently been completed by the Space Shuttle's Reusable Solid Rocket Motor (RSRM) nozzle program to completely characterize the effects of multi-axial loading, temperature and time on the failure characteristics of three filled epoxy adhesives (TIGA 321, EA913NA, EA946). As part of this effort, a single general failure criterion was developed that accounted for these effects simultaneously. This model was named the Multi- Axial, Temperature, and Time Dependent or MATT failure criterion. Due to the intricate nature of the failure criterion, some parameters were required to be calculated using complex equations or numerical methods. This paper documents some simple but accurate modifications to the failure criterion to allow for calculations of failure conditions without complex equations or numerical techniques.
Author
Failure Analysis; Models; Epoxy Resins; Adhesives; Numerical Analysis

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20030063168
An Analytical Performance Assessment of a Fuel Cell-Powered, Small Electric Airplane
June 2003; 17 pp.; In English; Novel Vehicle Concepts and Emerging Vehicle Technologies Symposium, 7-10 Apr. 2003, Brussels, Belgium; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 706-88-03
Report No.(s): NASA/TM-2003-212393; E-13972; NAS 1.15:212393; No Copyright; Avail: CASI; A03, Hardcopy

Rapidly emerging fuel cell power technologies may be used to launch a new revolution of electric propulsion systems for light aircraft. Future small electric airplanes using fuel cell technologies hold the promise of high reliability, low maintenance, low noise, and with exception of water vapor zero emissions. This paper describes an analytical feasibility and performance assessment conducted by NASA's Glenn Research Center of a fuel cell-powered, propeller-driven, small electric airplane based on a model of the MCR 01 two-place kitplane.
Author
Fuel Cells; Electric Motors; Feasibility Analysis; Light Aircraft

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20030062155 NASA Marshall Space Flight Center, Huntsville, AL, USA
Materials Science Research in the Microgravity Department of the Marshall Space Flight Center
Rogers, Jan R.; [2003]; 5 pp.; In English; Seminar at Kiwanas Club, 5 Dec. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Containerless processing is an important tool for thermophysical property measurements and materials research. The freedom from a crucible allows processing of liquid materials in a metastable undercooled state, as well as allowing processing of high temperature and highly reactive melts. ESL also has the potential to reduce internal flow velocities below those possible with electromagnetic, acoustic, or aero-acoustic techniques. The ESL facility at NASA's Marshall Space Flight Center (MSFC) is in use for thermophysical property measurements and materials research by a number of different internal and external investigators.
Author
Thermophysical Properties; Metastable State; Microgravity; Space Processing; High Temperature

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20030062262 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of NASA Technical Standards Program Relative to Enhancing Engineering Capabilities
Gill, Paul S.; Vaughan, William W.; [2003]; 7 pp.; In English; Space Technology and Applications International Forum, 2-6 Feb. 2003, Albuquerque, NM, USA; Copyright; Avail: CASI; A02, Hardcopy

The enhancement of engineering capabilities is an important aspect of any organization; especially those engaged in aerospace development activities. Technical Standards are one of the key elements of this endeavor. The NASA Technical Standards Program was formed in 1997 in response to the NASA Administrator s directive to develop an Agencywide Technical Standards Program. The Program s principal objective involved the converting Center-unique technical standards into Agency wide standards and the adoption/endorsement of non-Government technical standards in lieu of government standards. In the process of these actions, the potential for further enhancement of the Agency s engineering capabilities was noted relative to value of being able to access Agencywide the necessary full-text technical standards, standards update notifications, and integration of lessons learned with technical standards, all available to the user from one Website. This was accomplished and is now being enhanced based on feedbacks from the Agency's engineering staff and supporting contractors. This paper addresses the development experiences with the NASA Technical Standards Program and the enhancement of the Agency's engineering capabilities provided by the Program s products. Metrics are provided on significant aspects of the Program.
Author
NASA Programs; Engineering; Standards; Aerospace Industry

20030062814 University of Central Florida, Orlando, FL, USA, NASA Kennedy Space Center, Cocoa Beach, FL, USA
2002 Research Reports: NASA/ASEE Summer Faculty Fellowship Program
Kotnour, Tim, Editor; Black, Cassandra, Editor; December 2002; 167 pp.; In English; See also 20030062815 - 20030062831
Contract(s)/Grant(s): NAG10-315
Report No.(s): NASA/CR-2002-211181; NAS 1.26:211181; No Copyright; Avail: CASI; A08, Hardcopy

This document is a collection of technical reports on research conducted by the participants in the 2002 NASA/ASEE Faculty Fellowship Program at the John F. Kennedy Space Center (KSC). This was the 18th year that a NASA/ASEE program has been conducted at KSC. The 2002 program was administered by the University of Central Florida (UCF) in cooperation with KSC. The program was operated under the auspices of the American Society for Engineering Education (ASEE) and the Education Division, NASA Headquarters, Washington, D.C. The KSC Program was one of nine such Aeronautics and Space Research Programs funded by NASA Headquarters in 2002. The KSC Faculty Fellows spent ten weeks working with NASA scientists and engineers on research of mutual interest to the university faculty member and the NASA colleague. The editors of this document were responsible for selecting appropriately qualified faculty to address some of the many research areas of current interest to NASA/KSC. The NASA/ASEE program is intended to be a two-year program to allow in-depth research by the university faculty member.
Author
NASA Programs; Engineering; Research; University Program; Instructors

20030062825 Florida Inst. of Tech., FL, USA
Collapsible Cryogenic Storage Vessel Project
Fleming, David C.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 71-80; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Collapsible cryogenic storage vessels may be useful for future space exploration missions by providing long-term storage capability using a lightweight system that can be compactly packaged for launch. Previous development efforts have identified an 'inflatable' concept as most promising. In the inflatable tank concept, the cryogen is contained within a flexible pressure wall comprised of a flexible bladder to contain the cryogen and a fabric reinforcement layer for structural strength. A flexible, high-performance insulation jacket surrounds the vessel. The weight of the tank and the cryogen is supported by rigid support structures. This design concept is developed through physical testing of a scaled pressure wall, and through development of tests for a flexible Layered Composite Insulation (LCI) insulation jacket. A demonstration pressure wall is fabricated using Spectra fabric for reinforcement, and burst tested under noncryogenic conditions. An insulation test specimens is prepared to

demonstrate the effectiveness of the insulation when subject to folding effects, and to examine the effect of compression of the insulation under compressive loading to simulate the pressure effect in a nonrigid insulation blanket under the action atmospheric pressure, such as would be seen in application on the surface of Mars. Although pressure testing did not meet the design goals, the concept shows promise for the design. The testing program provides direction for future development of the collapsible cryogenic vessel concept.
Author
Cryogenic Storage; Inflatable Structures; Storage Tanks

20030062881 San Jose State Univ., CA, USA
Science Fairs as a Vehicle to Inspire the Next Generation of Scientists and Engineers
Okuda, Roy K.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 221-225; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

This viewgraph presentation describes the use of science fairs as a vehicle to increase the interest of students from grades K-12 in the field of science and engineering. The topics include: 1) Why Science Fairs?; 2) Levels of science fairs in the USA; 3) One community's approach: Science Fairs in Silicon Valley; 4) The Synopsys Championship; 5) The Intel International Science and Engineering Fair (ISEF); 6) Current Status in Silicon Valley; 7) Challenges; and 8) Educators and Professionals: how you can support student involvement in science fairs. A brief summary is also presented.
CASI
Engineers; Scientists; Education

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20030062051 RAND Corp., Santa Monica, CA
The Dynamics of Growth in Worldwide Satellite Communications Capacity
Mattock, Michael G.; Jan. 2002; 35 pp.; In English
Contract(s)/Grant(s): F49642-01-C-0003
Report No.(s): AD-A411859; RAND/MR-1613; No Copyright; Avail: CASI; A03, Hardcopy

The Department of Defense (DoD) cannot afford to own all the satellite communications capacity it might possibly need in all areas of the world. As noted in a previous RAND report, DoD planners estimate that they will need to provide about 16 Gigabits per second (Gbps) of bandwidth by 2010 to effectively support a joint-service operation. However, given current procurement plans, the DoD will only own only one-eighth of its projected desired capacity. Therefore, for the foreseeable future, the DoD will need to buy at least some of its communications capacity from commercial vendors. An ability to understand what drives growth in worldwide satellite capacity and to predict capacity would be useful to military communications planners in making decisions in advance to purchase and lease communications capacity in various parts of the world. In the empirical analysis in this report, we show that there is a strong relationship between growth in total satellite communications capacity and economic growth, as measured by Gross Domestic Product (GDP). Adjustment to change is quite rapid; if there is an imbalance in the long-run equilibrium between supply and demand, we estimate that on average 25 percent of the adjustment is made within one year, although there is some regional variation. The analysis indicates that the market can adjust swiftly to a surge in demand, and thus there may be little need to buy satellite capacity in advance simply to ensure that capacity will be there if needed.
DTIC
Artificial Satellites; Satellite Communication; Telecommunication; Military Spacecraft

20030062057 Telcordia Technologies Inc Morristown NJ, Morristown, NJ, USA
Enhancement of the Monet/Atonet Washington DC Network
Jackel, Janet; [2003]; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0167; Proj-J792
Report No.(s): AD-A411868; AFRL-IF-RS-TR-2003-9; No Copyright; Avail: CASI; A04, Hardcopy

Report discusses efforts to design, develop, implement, support, and demonstrate experimental activities performed on the MONET/ATDNet network and between MONET/ATDNet and other Next Generation Internet research networks. The report also describes research in the use of hierarchical multiplexing approaches for more efficient use of multi-wavelength networks and enhancements to the MONET Network Control & Management System. Specific experiments were performed for: (1) high speed transmission with alternative modulation formats (such as R7) with a long term goal of demonstrating 40 Obit/sec transmission between two nodes in the MONET Network; (2) exploring the limits on transmission of non-SONET rates (major example of which is SMPTE 292M 1.5 Obit/sec high definition television format) and find ways to extend the transmission to all MONET nodes with improved performance; and (3) exploring network stability, including addition of noise due to multipath interference and polarization effects and network behavior in the presence of transients, such as added and dropped channels.
DTIC
Multiplexing; Computer Networks

20030062776 Defence Research and Development Canada, Ottawa, Ontario, Canada
Analysing Command Challenges Using the Command and Control Framework: Pilot Study Results
McCann, Carol; Pigeau, Ross; English, Allan; Feb. 2003; 56 pp.; In English
Report No.(s): AD-A412190; DRDC-TR-2003-034; No Copyright; Avail: CASI; A04, Hardcopy

This paper describes a pilot study in which we explored the utility of the Pigeau-McCann framework for command and control for analyzing real-world military command challenges. The framework is a reconceptualization of command, control and C2 that is intended to provide a comprehensive and consistent base both for the scientific investigation of C2 and for the development of military C2 policy and doctrine. The study involved a preliminary assessment of the explanatory power of the framework in the context of actual situations in which military personnel confronted operational challenges. The results endorse the value of the framework as an approach for categorizing and quantifying significant aspects of command, of control and of C2. In addition, several areas were identified for improving the procedure used for analysis of the challenges. With refinement, the tool has strong potential to be used by the military to understand challenging C2 situations.
DTIC
Command And Control; Leadership

20030062923 Air Force Research Lab., Hanscom AFB, MA, USA
PAVE PAWS Radiation Decays Exponentially in Lossy Materials
Roberts, Thomas; Sep. 9, 2002; 54 pp.; In English
Report No.(s): AD-A411823; No Copyright; Avail: CASI; A04, Hardcopy

Dr. Rick Jostes asked us to give a talk for a National Research Council committee that is investigating aspects of a phased-array radar named PAVE PAWS. Dr. Jostes suggested that we discuss the relation of statements by Prof. Kurt Oughstun to my recent work on exponential decay of radiation in lossy materials. With that incentive, we found that most of the 88-years' of precursor literature is irrelevant to PAVE PAWS. Indeed, we will first list incident pulses mentioned by this literature, but whose spectra are not separated from DC. (DC is a synonym for frequency=0.) Such pulses cannot be produced by PAVE PAWS, which broadcasts from 420-450 MHz or, equivalently, 435 MHz + /- 3.5\%. We will also list parts of the literature that regard these types of pulses that PAVE PAWS cannot produce. This executive summary will also sketch answers to questions asked during our talk. This report's section after the transparencies will substantiate the executive summary.
DTIC
Radar Antennas; Antenna Radiation Patterns

20030062984 NASA Langley Research Center, Hampton, VA, USA
Inflatably Deployed Membrane Waveguide Array Antenna for Space
Lichodziejewski, David; Cravey, Robin; Hopkins, Glenn; [2003]; 7 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structures, Structural, 7-10 Apr. 2003, Norfolk, VA, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 2003-1649; Copyright; Avail: CASI; A02, Hardcopy

As an alternative to parabolic antennas and Synthetic Aperture Radar (SAR) systems, waveguide arrays offer another method of providing RF transmit/receive communication apertures for spacecraft. The advantage of the membrane waveguide array concept, in addition to its lightweight and low packaged volume, is its inherent shape. Relative to parabolic antennas, the requirement to make an accurate doubly curved surface is removed. L'Garde and Langley Research Center (LaRC), are currently working in this area to develop lightweight waveguide array technologies utilizing thin film membrane structures.

Coupled with an ultra-lightweight inflatably deployed rigidizable planar support structure, the system offers a very compelling technology in the fields of space-based radar, communications, and earth resource mapping.
Author
Antenna Arrays; Waveguide Antennas; Synthetic Aperture Radar; Membrane Structures; Parabolic Antennas; Planar Structures

20030063024 Naval Postgraduate School, Monterey, CA
An Analysis of Communications Between the USA Army Communications-Electronics Command and Industry
College, Linda; Dec. 2002; 119 pp.; In English
Report No.(s): AD-A411491; No Copyright; Avail: CASI; A06, Hardcopy

This research examines the methods of communications utilized between the U. S. Army's Communications-Electronics Command (CECOM), Port Monmouth, New Jersey and its supplier base. The primary intent is to examine the effectiveness at various communication methods. As part of this discussion of communications, this thesis will discuss various methods utilized by the CECOM Acquisition Center to interface with industry, but will specifically address three methods. These three methods consist of the Joint Partnering Contractor (JPC), Technical and Industry Liaison Office (TILO) and the US Army Interagency Interactive Business Opportunities Page (IBOP). Finally, this thesis will analyze the effectiveness at the methods utilized by the CECOM Acquisition Center and make recommendations on how these methods can improve.
DTIC
Industries; Military Technology; Armed Forces (United States); Electronics; Communication

20030063114 NASA Marshall Space Flight Center, Huntsville, AL, USA
HDTV From the International Space Station
Grubbs, Rodney; [2003]; 8 pp.; In English; University of South Florida Seminar, 28 Mar. 2003, Tampa, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

This viewgraph representation presents an overview of development of an improved high definition television system (HDTV) for the International Space Station (ISS). Topics covered include: current ISS video system, experience with HD camcorders on-orbit, live HD on-orbit requirements, ISS HDTV downlink, HD downlink test and future plans
CASI
High Definition Television; Communication Equipment; International Space Station; Downlinking; Television Systems

20030063162 NASA Glenn Research Center, Cleveland, OH, USA
Implementing an Automated Antenna Measurement System
Valerio, Matthew D.; Romanofsky, Robert R.; VanKeuls, Fred W.; June 2003; 9 pp.; In English; NIWeek 2003, 13-15 Aug. 2003, Austin, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-322-20-02
Report No.(s): NASA/TM-2003-212337; E-13932; NAS 1.15:212337; Copyright; Avail: CASI; A02, Hardcopy

We developed an automated measurement system using a PC running a LabView application, a Velmex BiSlide X-Y positioner, and a HP85l0C network analyzer. The system provides high positioning accuracy and requires no user supervision. After the user inputs the necessary parameters into the LabView application, LabView controls the motor positioning and performs the data acquisition. Current parameters and measured data are shown on the PC display in two 3-D graphs and updated after every data point is collected. The final output is a formatted data file for later processing.
Author
Microwave Frequencies; Data Acquisition; Antenna Arrays; Antenna Design

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20030062140 Aerospace Corp., El Segundo, CA, USA
Overview of the Design, Development, and Application of Nickel-Hydrogen Batteries
Thaller, Lawrence H.; Zimmerman, Albert H.; June 2003; 43 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-755-12-05
Report No.(s): NASA/TP-2003-211905; E-13595; NAS 1.60:211905; No Copyright; Avail: CASI; A03, Hardcopy

This document provides an overview of the design, development, and application of nickel-hydrogen (Ni-H2) battery technology for aerospace applications. It complements and updates the information presented in NASA RP-1314, NASA Handbook for Nickel- Hydrogen Batteries, published in 1993. Since that time, nickel-hydrogen batteries have become widely accepted for aerospace energy storage requirements and much more has been learned. The intent of this document is to capture some of that additional knowledge. This document addresses various aspects of nickel-hydrogen technology including the electrochemical reactions, cell component design, and selection considerations; overall cell and battery design considerations; charge control considerations; and manufacturing issues that have surfaced over the years that nickel-hydrogen battery technology has been the major energy storage technology for geosynchronous and low-Earth-orbiting satellites.
Author
Nickel Hydrogen Batteries; Hydrogen; Manufacturing; Technology Utilization; Design Analysis

20030062294 Massachusetts Univ., Lowell, MA
Noisy Quantum Computation and Communication
Ruskai, Mary B.; Mar. 3, 2003; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0065
Report No.(s): AD-A412013; ARO-43509.1-PH-QC; No Copyright; Avail: CASI; A02, Hardcopy
When quantum particles are used to transmit information, one can expect that, as with classical communication, noise in the channel will affect the fidelity of the transmission. This is true whether the particles are used to transmit quantum or classical information. Similar concerns arise in quantum computation when the noise due to interactions with the environment gives rise to errors. This project has been concerned with the analysis of noise that breaks entanglement and with the development of new codes for quantum error correction.
DTIC
Quantum Theory; Quantum Electronics; Quantum Computation

20030062771 BAE Systems, Nashua, NH, USA
Development of a Bright Peak Enhanced X-Ray Phase Shifting Mask BPEXPM
Cerrina, Franco; Taylor, James W.; 27 Feb. 2003; 8 pp.; In English
Contract(s)/Grant(s): N00424-02-C-3029
Report No.(s): AD-A412072; BAA01-08; No Copyright; Avail: CASI; A02, Hardcopy
Under a separate DARPA grant, the Center for NanoTechnology (CNTech) had developed and patented (Yang, Lei, Taylor, J.W., and Cerrina, F., 'Enhanced Bright Peak Clear Phase Shifting Mask and Methods of Use', U.S. Patent 6,428, 939, August 6, 2002, application filed 03/22/01) the concept of using a clear phase X-ray mask called the Bright Peak Enhanced X-ray Phase Mask (BPEXPM) to produce reduced features on the wafer from larger features on the mask.
DTIC
Nanotechnology; Phase Shift Circuits; X Rays; Semiconductor Devices

20030062844 San Jose State Univ., CA, USA
Exploring Solar Cells: A Freshman Engineering Project
Allen, Emily L.; Vu, Huong; Parent, David; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 95-101; In English; See also 20030062842; Original contains black and white illustrations
Contract(s)/Grant(s): NSF DUE-99-52707; No Copyright; Avail: CASI; A02, Hardcopy
A viewgraph presentation on exploring solar cells is given. Some of the topics include: 1) E10: Introduction to Engineering; 2) E10 Project Goals; 3) Project Activities; 4) Related Activities; 5) E10 Lecture; 6) Uses for Solar Energy; 7) What is a Solar Cell?; 8) Basic Physics of Solar Cells; 9) Generating Charges from the Sun; and 10) Solar Cell Fabrication.
CASI
Solar Cells; Solar Energy; Semiconductors (Materials); Microelectronics

20030062858 University of Southern Maine, Gorham, ME, USA
Understanding Motor Operation by Building an Single-Pole Pulse Electric Motor
Marshall, John A.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 499-502; In English; See also 20030062842; No Copyright; Avail: CASI; A01, Hardcopy
An activity is presented to understand basic electric motor principles and the materials needed to convert electricity and

magnetism into motion. A single pole pulse electric motor is built to understand motor operations.
Derived from text
Electric Motors; Magnetic Properties; Mechanical Engineering; Electricity

20030062875 Kentucky Univ., Lexington, KY, USA
KEEP: Kentucky Electronics Education Project, Microelectronics as a Theme in Math and Science
Lumpp, Janet K.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 319-331; In English; See also 20030062842; Original contains black and white illustrations
Contract(s)/Grant(s): NSF ECS-97-02108; NSF DMR-98-09686; No Copyright; Avail: CASI; A03, Hardcopy

A technique is presented for students to learn basic circuit assembly skills, conductors, nonconductors, components, solder, and also to increase background knowledge of teachers in the area of electronics. The Kentucky Electronics Education Project is the education component of two NSF research grants aimed at introducing pre-college students to microelectronics. Working with middle school and senior high school teachers, we are developing curriculum materials and classroom activities using microelectronics as a theme to teach basic concepts in chemistry, math, and physics. Topics include copper etching and plating, semiconductors, insulators, conductors, energy conversion, heat transfer, materials properties, dimensions, routing, soldering, and component types. The emphasis is not vocational training; rather it is the use of a real world example as a theme to integrate basic principles from different disciplines. Activities to date have included classroom circuit building projects, fieldtrips, and teacher workshops. Middle school and high school students have successfully patterned, etched, drilled, and soldered working circuits and enthusiasm is equally distributed among boys and girls. The long term goals are to serve as a resource for school teachers, recruit students into engineering and science careers, and increase public awareness of the exciting advancements in microelectronics.
Derived from text
Education; Microelectronics; Kentucky; Applications Of Mathematics; Science

20030062887 Costa Rica Univ., San Jose, Costa Rica
Experiments with an AC-DC Dropping Voltage Welding Power Source
Umana, Carlos E.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 503-509; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

An experiment is designed to familiarize welding students with the arc behavior and the basic parameters of arc welding power sources. In this experiment, students will demonstrate the characteristic voltage-current curves of a welding ower source, the arc blow effect, the heat distribution between electrodes from AC versus DC mode operation, and the heat distribution between electrodes for DC mode operation.
CASI
Arc Welding; Electric Potential; Electrodes; Electric Power; Direct Current; Alternating Current

20030062902 Johns Hopkins Univ., Baltimore, MD
Design Principles for Insulated Internal Loopless MRI Receivers
Susil, Robert C.; Yeung, Christopher J.; Atalar, Ergin; Oct. 25, 2001; 4 pp.; In English
Report No.(s): AD-A411635; No Copyright; Avail: CASI; A01, Hardcopy

A theoretical analysis of insulated internal loopless MRI receivers is presented. Insulated loopless receivers are ideal for local, high resolution imaging of the vasculature and other internal organs. However, there are currently no analysis techniques or design principles for these devices. By using a Galerkin method of moments combined with an application of the volume equivalence theorem, we solve for the intrinsic SNR distribution of insulated loopless receivers. As insulation thickness is increased, the resonant antenna length increases while the noise resistance decreases. Both of these effects, when used together, can greatly improve the SNR magnitude and distribution of loopless receivers. Design principles outlined here will allow for optimization of loopless receivers for a variety of internal, high resolution imaging applications.
DTIC
Receivers; Magnetic Resonance; Imaging Techniques; Design Analysis

20030062925 Naval Surface Warfare Center Crane Div. IN, Crane, IN, USA
A Comparison of Gyroscope Digital Models for an Electro-Optical/Infrared Guided Missile Simulation
Waggoner, Brent A.; Feb. 2003; 214 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411726; NSWC/CR-RDTR-03/12; No Copyright; Avail: CASI; A10, Hardcopy

This report was prepared by the author as a Master's thesis which partially fulfilled the requirements for a Master of Science degree in Electrical Engineering from Rose Hulman Institute of Technology, Terre Haute IN. Equations of motion and digital models of a gyroscope were developed for use in electro-optical/infrared missile simulations. Three different models were developed, of varying complexity. Results from these models were compared to actual gyro test data to evaluate the fidelity of the various gyroscope models.
DTIC
Digital Systems; Missiles; Digital Simulation; Electro-Optics

20030062945 Department of the Navy, Washington, DC
Wireless Multiconductor Cable Test System and Method
Pereira, Fernando J., Inventor; Huot, Raymond U., Inventor; Oct. 8, 2002; 24 pp.; In English
Patent Info.: Filed 8 Oct. 2002; US-Patent-Appl-SN-10267885
Report No.(s): AD-D020059; No Copyright; Avail: Other Sources

A tester for testing multiconductor cable having a first tester is connectable to a first end of the multiconductor cable. The first tester produces one or more test signals individually on each conductor of the cable. A second tester is connectable to the second end of the cable at a remote location. The second tester monitors each of the plurality of separate conductors to detect the test signals produced by the first tester. Preferably, a first wireless transceiver is provided for the first tester that wirelessly transmits control signals to automatically coordinate testing procedure control. A second wireless transceiver joined to the second tester wirelessly transmits test result data.
DTIC
Patent Applications; Conductors; Wireless Communication; Transmitter Receivers

20030062973 Universidad Politecnica de Valencia, Valencia, Spain
Flat Panel Displays for Medical Monitoring Systems
Cebrian, A.; Millet, J.; Garcia, I.; 25 Oct. 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411625; No Copyright; Avail: CASI; A01, Hardcopy

Flat panel displays are ideal for demanding hospital and clinic applications like vital sign monitoring and bedside administration. They take up much less space than conventional monitors (CRT based) and can be wall-mounted cart-mounted or used on a desk stand. User friendly interface demands easy to use input device rotary position encoders and touch screen panels offers simplicity replacing bulky keyboards. This article will present an overview about today medical monitoring systems tendencies describing as an example a custom medical monitoring module developed to be integrated in an assisted ventilation system.
DTIC
Flat Panel Displays; Medical Equipment; Systems Engineering; Electronic Modules

20030062980 University of Southern California, Los Angeles, CA
Optoelectronic Integrated Circuits Fabricated Using Atomic Layer Epitaxy
Dapkus, P. D.; Jul. 1995; 133 pp.; In English
Contract(s)/Grant(s): DAAL03-92-G-0234
Report No.(s): AD-A411541; ONR/SD-30500.1-EL-SD1; No Copyright; Avail: CASI; A07, Hardcopy

Atomic Layer Epitaxy (ALE) is studied for use in the fabrication of optoelectronics integrated circuits, A new approach to ALE is investigated in which the process is performed under UHV conditions using organometallic compounds a sources for the reactive species. A vacuum ALE system was constructed and the mechanisms for growth of GaAs using trimethylgallium (TMGa) and tertiarybutylarsine (TBAs) were investigated using a set of in situ tools -reflection difference spectroscopy, mass spectroscopy, and reflection high energy electron diffraction. Studies of the interplay of total growth rate and background impurity (Carbon) incorporation were investigated. The growth rate was found to be limited by the exposure time required to insure complete removal of the CH3 species from the surface to reduce C incorporation. Selective area growth of GaAs on patterned substrates was undertaken to investigate the orientation dependences of the growth morphology on pattern direction.
DTIC
Gallium Arsenides; Crystal Growth; Atomic Layer Epitaxy; Optoelectronic Devices; Integrated Circuits; Fabrication; Electro-Optics

20030063050 Glamorgan Univ., Pontypridd, Glamorgan, UK

A Transceiver for Direct Phase Measurement Magnetic Induction Tomography

Watson, S.; Williams, R. J.; Griffiths, H.; Gough, W.; Morris, A.; Oct. 25, 2001; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411517; No Copyright; Avail: CASI; A01, Hardcopy

Magnetic induction Tomography (MIT) is a technique for imaging the electromagnetic properties of materials. Excitation coils are used to induce eddy currents within the sample volume which are then sensed by receiver coils. The technique has attracted interest for biomedical application due to the non-contacting nature of the measurements, which may provide advantages over electrode based impedance tomography in certain applications. The paper describes a transceiver designed for use in a prototype biomedical MIT system operating with a single excitation frequency of 10 MHz. To improve channel isolation and phase stability during signal distribution, the received signals undergo heterodyne downconversion to 10 kHz, filtering and limiting at the transceiver. Direct phase measurement between the downconverted reference and received signals is then undertaken to measure the signal perturbation due to the induced conduction eddy currents.

DTIC

Magnetic Induction; Tomography; Transmitter Receivers

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20030062073 NASA Marshall Space Flight Center, Huntsville, AL, USA

Diffusion of Hydrogen in Silica under Transient Conditions

Palosz, W.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Development of hydrogen in sealed silica glass ampoules during annealing at elevated temperatures was investigated. The dependence of hydrogen pressure in the ampoules as a function of time, for different temperatures and ampoule parameters was measured. The process was modeled assuming chemical solution of hydrogen according to the reaction: silica + H2 = H-Si= + H-O-Si=. The equilibrium constant of the reaction was determined by fitting the theoretical curves to the experimental data. The Gibbs function for this reaction was estimated at deltaG = -25.8 + 54T.

Author

Hydrogen; Thermal Diffusion; Pressure Measurement; Temperature Measurement; Chemical Reactions; Gas Pressure

20030062126 NASA Glenn Research Center, Cleveland, OH, USA

On the Physics of Flow Separation Along a Low Pressure Turbine Blade Under Unsteady Flow Conditions

Schobeiri, Meinhard T.; Ozturk, Burak; Ashpis, David E.; June 2003; 21 pp.; In English; Turbo Expo 2003, 16-19 Jun. 2003, Atlanta, GA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC3-793; WBS 22-708-28-07

Report No.(s): NASA/TM-2003-212290; E-13852; NAS 1.15:212290; GT-2003-38917; No Copyright; Avail: CASI; A03, Hardcopy

The present study, which is the first of a series of investigations dealing with specific issues of low pressure turbine (LPT) boundary layer aerodynamics, is aimed at providing detailed unsteady boundary flow information to understand the underlying physics of the inception, onset, and extent of the separation zone. A detailed experimental study on the behavior of the separation zone on the suction surface of a highly loaded LPT-blade under periodic unsteady wake flow is presented. Experimental investigations were performed at Texas A&M Turbomachinery Performance and Flow Research Laboratory using a large-scale unsteady turbine cascade research facility with an integrated wake generator and test section unit. To account for a high flow deflection of LPT-cascades at design and off-design operating points, the entire wake generator and test section unit including the traversing system is designed to allow a precise angle adjustment of the cascade relative to the incoming flow. This is done by a hydraulic platform, which simultaneously lifts and rotates the wake generator and test section unit. The unit is then attached to the tunnel exit nozzle with an angular accuracy of better than 0.05 , which is measured electronically. Utilizing a Reynolds number of 110,000 based on the blade suction surface length and the exit velocity, one steady and two different unsteady inlet flowconditions with the corresponding passing frequencies, wake velocities and turbulence intensities are investigated using hot-wire anemometry. In addition to the unsteady boundary layer measurements, blade surface pressure measurements were performed at Re=50,000, 75,000, 100,000, and 125,000 at one steady and two

periodic unsteady inlet flow conditions. Detailed unsteady boundary layer measurement identifies the onset and extent of the separation zone as well as its behavior under unsteady wake flow. The results presented in ensemble-averaged and contour plot forms contribute to understanding the physics of the separation phenomenon under periodic unsteady wake flow. Several physical mechanisms are discussed.
Author
Boundary Layers; Turbomachinery; Turbine Blades; Turbulent Wakes; Unsteady Flow; Separated Flow; Low Pressure; Wind Tunnel Tests

20030062173 NASA Marshall Space Flight Center, Huntsville, AL, USA
Vision for CFD-Based Combustion Instability Predictions
Rocker, Marvin; West, Jeffrey S.; April 15, 2003; 29 pp.; In English; NASA Spring Workshop on Fluids, 22-24 Apr. 2003, Birmingham, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation presents an overview of the proposed development for computational fluid dynamics (CFD) based combustion instability predictions. These predictions are discussed in regard to Next Generation Launch Technologies (NGLT). Topics covered include: relevance of combustion instability to NGLT, evolution of combustion instability prediction techniques, and development of CFD-based models to support combustion instability predictions to support NGLT and beyond.
CASI
Combustion Stability; Computational Fluid Dynamics; Prediction Analysis Techniques; Launch Vehicles; Spacecraft Propulsion; Mathematical Models

20030062175 NASA Glenn Research Center, Cleveland, OH, USA
Optimal Disturbances in Boundary Layers Subject to Streamwise Pressure Gradient
Ashpis, David E.; Tumin, Anatoli; May 2003; 13 pp.; In English; 16th Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-991; WBS 22-274-00-206
Report No.(s): NASA/TM-2003-212288; AIAA Paper 2003-4242; NAS 1.15:212288; E-13850; Copyright; Avail: CASI; A03, Hardcopy

An analysis of the non-modal growth of perturbations in a boundary layer in the presence of a streamwise pressure gradient is presented. The analysis is based on PSE equations for an incompressible fluid. Examples with Falkner- Skan profiles indicate that a favorable pressure gradient decreases the non-modal growth while an unfavorable pressure gradient leads to an increase of the amplification. It is suggested that the transient growth mechanism be utilized to choose optimal parameters of tripping elements on a low-pressure turbine (LPT) airfoil. As an example, a boundary-layer flow with a streamwise pressure gradient corresponding to the pressure distribution over a LPT airfoil is considered. It is shown that there is an optimal spacing of the tripping elements and that the transient growth effect depends on the starting point. The amplification is found to be small at the LPT s very low Reynolds numbers, but there is a possibility to enhance the transient energy growth by means of wall cooling.
Author
Pressure Gradients; Boundary Layers; Perturbation; Pressure Distribution; Airfoils; Incompressible Fluids

20030062215 Illinois Univ., Urbana, IL, USA
Engineering Solutions for Robust and Efficient Microfluidic Biomolecular Systems: Mixing, Fabrication, Diagnostics, Modeling, Antifouling and Functional Materials
Moore, Jeff; Aref, Hassan; Adrian, Ron; Leckband, Deborah; Beebe, David J.; Sep. 2002; 20 pp.; In English
Contract(s)/Grant(s): F33615-98-1-2853; Proj. ARPP
Report No.(s): AD-A411413; AFRL-PR-WP-TM-2003-2014; No Copyright; Avail: CASI; A03, Hardcopy

We have developed several key components for microfluidic bioanalysis systems, including the following: 1. Microfluidic component fabrication and prototyping 2. Development of microflow diagnostic tools 3. Micron-scale fluid flow mixing enhancement 4. Flow modeling of micromixing processes 5. Biomolecular fluid stream handling and anti-fouling techniques 6. Spatial and temporal zeta potential control 7. Integration of functional materials in microfluidic systems.
DTIC
Fluidics; Mixing; Molecules; Fluid Flow; Microelectromechanical Systems

20030062258 Combustion Research and Flow Technology, Inc., Dublin, PA, USA

Modeling Cavitation in Cryogenic Fluids: Validation for Liquid Nitrogen, Hydrogen, and Oxygen

Hosangadi, Ashvin; Ahuja, Vineet; 15 Apr. 2003; 37 pp.; In English; MSFC Spring Fluids Workshop, 22-24 Apr. 2003, Birmingham, AL, USA

Contract(s)/Grant(s): NAS8-02098; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides an overview of research designed to provide a numerical framework model for unsteady cavitation in cryogenic fluids. The proposed modeling is tested using liquid nitrogen, hydrogen and oxygen. Topics considered include: background information on thermal effects in cavitation, multi-phase cavitation formulation with thermal effects, acoustic behavior of such a system, cavitation source terms and Crunch CFD(Register Trademark) Code capabilities. CASI

Cavitation Flow; Cryogenic Fluids; Mathematical Models; Computational Fluid Dynamics; Computerized Simulation; Unsteady Flow

20030062783 Notre Dame Univ., IN

Fluid-Optic Interactions III (Adaptive-Optic)

Jumper, Eric J.; 10 Feb. 2003; 28 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0025; FQ8671-00-0-0426

Report No.(s): AD-A412253; AFRL-SR-AR-TR-03-0069; No Copyright; Avail: CASI; A03, Hardcopy

This report describes fluid-optic interaction research at the University of Notre Dame. When a laser beam propagates through a variable-index-of-refraction, turbulent fluid, its wavefront becomes aberrated, reducing associated optical-system performance. For flight Mach numbers above 0.6 Mach, 'compressibility' effects in the flow past the aircraft become important in aberrating wavefronts (aero-optics). This report presents experimental validation for the mechanism responsible for these aberrations in high, subsonic-Mach, free shear-layer flows, the so-called Weakly-Compressible Model. The data collected for this validation clearly shows that deep static pressure wells form in the coherent structures naturally present in shear layers. The presence of these static pressure wells overturns the previously-held belief that static-pressure fluctuations in shear layers are negligible. Results of a study using Proper Orthogonal Decomposition (POD) are also presented. These results suggest that POD methods can be extremely useful in solving some of the high-speed wavefront sensing issues associated with mitigating shear-layer induced aero-optical effects.

DTIC

Turbulence; Compressible Flow; Adaptive Optics

20030062788 NASA Glenn Research Center, Cleveland, OH, USA

Study of Unsteady Flows With Concave Wall Effect

Wang, Chi R.; June 2003; 16 pp.; In English; 21st Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-713-82-43

Report No.(s): NASA/TM-2003-212394; E-13977; NAS 1.15:212394; AIAA Paper 2003-4073; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents computational fluid dynamic studies of the inlet turbulence and wall curvature effects on the flow steadiness at near wall surface locations in boundary layer flows. The time-stepping RANS numerical solver of the NASA Glenn-HT RANS code and a one-equation turbulence model, with a uniform inlet turbulence modeling level of the order of 10 percent of molecular viscosity, were used to perform the numerical computations. The approach was first calibrated for its predictabilities of friction factor, velocity, and temperature at near surface locations within a transitional boundary layer over concave wall. The approach was then used to predict the velocity and friction factor variations in a boundary layer recovering from concave curvature. As time iteration proceeded in the computations, the computed friction factors converged to their values from existing experiments. The computed friction factors, velocity, and static temperatures at near wall surface locations oscillated periodically in terms of time iteration steps and physical locations along the span-wise direction. At the upstream stations, the relationship among the normal and tangential velocities showed vortices effects on the velocity variations. Coherent vortices effect on the velocity components broke down at downstream stations. The computations also predicted the vortices effects on the velocity variations within a boundary layer flow developed along a concave wall surface with a downstream recovery flat wall surface. It was concluded that the computational approach might have the potential to analyze the flow steadiness in a turbine blade flow.

Author

Turbulence Models; Computational Fluid Dynamics; Unsteady Flow; Curvature; Boundary Layer Flow

20030062790 Michigan Univ., Ann Arbor, MI, USA

Flow/Soot-Formation Interactions in Nonbuoyant Laminar Diffusion Flames

Dai, Z.; Lin, K.-C.; Sunderland, P. B.; Xu, F.; Faeth, G. M.; December 15, 2002; 110 pp.; In English

Contract(s)/Grant(s): NAG3-661

Report No.(s): GDL-GMF-02-04; No Copyright; Avail: CASI; A06, Hardcopy

This is the final report of a research program considering interactions between flow and soot properties within laminar diffusion flames. Laminar diffusion flames were considered because they provide model flame systems that are far more tractable for theoretical and experimental studies than more practical turbulent diffusion flames. In particular, understanding the transport and chemical reaction processes of laminar flames is a necessary precursor to understanding these processes in practical turbulent flames and many aspects of laminar diffusion flames have direct relevance to turbulent diffusion flames through application of the widely recognized laminar flamelet concept of turbulent diffusion flames. The investigation was divided into three phases, considering the shapes of nonbuoyant round laminar jet diffusion flames in still air, the shapes of nonbuoyant round laminar jet diffusion flames in coflowing air, and the hydrodynamic suppression of soot formation in laminar diffusion flames.

Author (revised)

Soot; Flow Characteristics; Laminar Flow; Diffusion Flames

20030062830 Florida Inst. of Tech., FL, USA

Fluid Dynamics of Small, Rugged Vacuum Pumps of Viscous-Drag Type

Russell, John M.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 139-148; In English; See also 20030062814; No Copyright; Avail: CASI; A02, Hardcopy

The need to identify spikes in the concentration of hazardous gases during countdowns to space shuttle launches has led Kennedy Space Center to acquire considerable expertise in the design, construction, and operation of special-purpose gas analyzers of mass-spectrometer type. If such devices could be miniaturized so as to fit in a small airborne package or backpack them their potential applications would include integrated vehicle health monitoring in later-generation space shuttles and in hazardous material detection in airports, to name two examples. The bulkiest components of such devices are vacuum pumps, particularly those that function in the low vacuum range. Now some pumps that operate in the high vacuum range (e.g. molecular-drag and turbomolecular pumps) are already small and rugged. The present work aims to determine whether, on physical grounds, one may or may not adopt the molecular-drag principle to the low-vacuum range (in which case viscous-drag principle is the appropriate term). The deliverable of the present effort is the derivation and justification of some key formulas and calculation methods for the preliminary design of a single-spool, spiral-channel viscous-drag pump.

Author

Fluid Dynamics; Vacuum Pumps; Viscous Drag; Mathematical Models; Aerospace Engineering

20030062895 Tsinghua Univ., Bejing, China

Multiple Color Stimulus Induced Steady State Visual Evoked Potentials

Cheng, M.; Gao, X.; Gao, S.; Xu, D.; Oct. 25, 2001; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411770; No Copyright; Avail: CASI; A01, Hardcopy

Steady state visual evoked potentials (SSVEP) are of the characteristics of high SNR and effectiveness in short-term identification of evoked responses. In most of the SSVEP experiments, single high frequency stimuli are used. To characterize the complex rhythms in SSVEP, a new multiple color stimulus pattern is proposed in this paper FFT and bispectrum analysis methods are used to detect the phase coupling of the two stimulation frequencies in the recorded SSVEP. The results show that the rhythms at the duplation, sum or difference of the two stimulation frequencies can be evoked by multiple color stimulus.

DTIC

Steady State; Visual Perception; Visual Signals; Color; Sensory Stimulation

20030063047 NASA Marshall Space Flight Center, Huntsville, AL, USA

Thermal Exposure Effects on Properties of Al-Li Alloy Plate Products

Shah, Sandeep; Wells, Douglas; Wagner, John; Babel, Henry; November 25, 2002; 1 pp.; In English; AeroMat 2003, 9-12 Jun. 2003, Dayton, OH, USA; Copyright; Avail: Other Sources; Abstract Only

Aluminum-Lithium (AL-Li) alloys offer significant performance benefits for aerospace structural applications due to their higher specific properties compared with conventional aluminum alloys. For example, the application of an Al-Li alloy to the

space shuttle external cryogenic fuel tank contributed to the weight savings that enabled successful deployment of International Space Station components. The composition and heat treatment of this alloy were optimized specifically for strength-toughness considerations for an expendable cryogenic tank. Time dependent properties related to reliability, such as thermal stability, fatigue, and corrosion, will be of significant interest when materials are evaluated for a reusable cryotank structure. As most aerospace structural hardware is weight sensitive, a reusable cryotank will be designed to the limits of the materials mechanical properties. Therefore, this effort was designed to establish the effects of thermal exposure on the mechanical properties and microstructure of one relatively production mature alloy and two developmental alloys C458 and L277. Tensile and fracture toughness behavior was evaluated after exposure to temperatures as high as 3oooF for up to IO00 hrs. Microstructural changes were also evaluated to correlate with the observed data trends. The ambient temperature parent metal data showed an increase in strength and reduction in elongation after exposure at lower temperatures. Strength reached a peak with intermediate temperature exposure followed by a decrease at highest exposure temperature. Characterizing the effect of thermal exposure on the properties of Al-Li alloys is important to defining a service limiting temperature, exposure time, and end-of-life properties.

Author

Aluminum-Lithium Alloys; Temperature Effects; Cryogenic Fluid Storage; Fuel Tanks; Fracture Strength; Structural Design; Thermal Stability

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20030062033 NASA Marshall Space Flight Center, Huntsville, AL, USA

Multiple-etalon systems for the Advanced Technology Solar Telescope

Gary, G. Allen; Balasubramaniam, K. S.; Sigwarth, Michael; Innovative Telescopes and Instrumentation for Solar Astrophysics; 2003; Volume 4853; 22 pp.; In English; Proceedings of the SPIE Reprint, 24-28 Aug. 2002, Waikoloa, HI, USA; Copyright; Avail: Other Sources

Multiple etalon systems are discussed that meet the science requirements for a narrow-passband imaging system for the 4-meter National Solar Observatory (NSO)/Advance Technology Solar Telescope (ATST). A multiple etalon system can provide an imaging interferometer that works in four distinct modes: as a spectro-polarimeter, a filter-vector magnetograph, an intermediate-band imager, and broadband high-resolution imager. Specific dual and triple etalon configurations are described that provide a spectrographic passband of 2.0-3.5 micron and reduce parasitic light levels to 10(exp -4) as required for precise polarization measurement, e.g., Zeeman measurements of magnetic sensitive lines. A TESOS-like (Telecentric Etalon SOlar Spectrometer) triple etalon system provides a spectral purity of 10(exp -5). The triple designs have the advantage of reducing the finesse requirement on each etalon; allow the use of more stable blocking filters, and have very high spectral purity. A dual-etalon double-pass (Cavallini-like) system can provide a competing configuration. Such a dual-etalon design can provide high contrast. The selection of the final focal plane instrument will depend on a trade-off between an ideal instrument and practical reality. The trade study will include the number of etalons, their aperture sizes, complexities of the optical train, number of blocking filters, configuration of the electronic control system, computer interfaces, temperature controllers, etalon controllers, and their associated feedback electronics. The heritage of single and multiple etalon systems comes from their use in several observatories, including the Marshall Space Flight Center (MSFC) Solar Observatory, Sacramento Peak Observatory (NSO), and Kiepenheuer-Institut fur Sonnenphysik (KIS, Germany), Mees Solar Observatory (University of Hawaii), and Arcetri Astrophysical Observatory (Italy). The design of the ATST multiple etalon system will benefit from the experience gained at these observatories.

Author

Solar Observatories; Etalons; Imaging Techniques; Polarimeters; Magnetic Signatures

20030062035 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Biomedical Investigations with Laser-Polarized Noble Gas Magnetic Resonance

Walsworth, Ronald L.; June 2003; 8 pp.; In English

Contract(s)/Grant(s): NAG9-1166; No Copyright; Avail: CASI; A02, Hardcopy

We pursued advanced technology development of laser-polarized noble gas nuclear magnetic resonance (NMR) as a novel

biomedical imaging tool for ground-based and eventually space-based application. This new multidisciplinary technology enables high-resolution gas-space magnetic resonance imaging (MRI)-e.g., of lung ventilation-as well as studies of tissue perfusion. In addition, laser-polarized noble gases (3He and 129Xe) do not require a large magnetic field for sensitive detection, opening the door to practical MRI at very low magnetic fields with an open, lightweight, and low-power device. We pursued two technology development specific aims: (1) development of low-field (less than 0.01 T) noble gas MRI of humans; and (2) development of functional MRI of the lung using laser-polarized noble gas and related techniques.
Author
Nuclear Magnetic Resonance; Rare Gases; Optical Depolarization; Magnetic Fields; Research And Development; Imaging Techniques

20030062071 United Arab Emirates Univ., Al-Ain, United Arab Emirates
Auto-Threshold Peak Detection in Physiological Signals
Jacobson, M. L.; Oct. 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412098; No Copyright; Avail: CASI; A01, Hardcopy

In processing physiological signals, it is often necessary to detect periodic, local maxima. There are a variety of peak detection algorithms, but most require a threshold value in order to distinguish peaks from the rest of the data. This brief paper presents implementation of a peak detection algorithm using Matlab and introduces an innovative method for estimating the threshold value. Keywords: Peak detection, electrocardiogram, Matlab
DTIC
Signal Processing; Electrocardiography; Maxima

20030062101 NASA Marshall Space Flight Center, Huntsville, AL, USA
SUBSA and PFMI Transparent Furnace Systems Currently in use in the International Space Station Microgravity Science Glovebox
Spivey, Reggie A.; Gilley, Scott; Ostrogorsky, Aleksander; Grugel, Richard; Smith, Guy; Luz, Paul; [2003]; 1 pp.; In English; American Inst. for Aeronautics and Astronautics 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Copyright; Avail: Other Sources; Abstract Only

The Solidification Using a Baffle in Sealed Ampoules (SUBSA) and Pore Formation and Mobility Investigation (PFMI) furnaces were developed for operation in the International Space Station (ISS) Microgravity Science Glovebox (MSG). Both furnaces were launched to the ISS on STS-111, June 4, 2002, and are currently in use on orbit. The SUBSA furnace provides a maximum temperature of 850 C and can accommodate a metal sample as large as 30 cm long and 12mm in diameter. SUBSA utilizes a gradient freeze process with a minimum cooldown rate of 0.5C per min, and a stability of +/- 0.15C. An 8 cm long transparent gradient zone coupled with a Cohu 3812 camera and quartz ampoule allows for observation and video recording of the solidification process. PFMI is a Bridgman type furnace that operates at a maximum temperature of 130C and can accommodate a sample 23cm long and 10mm in diameter. Two Cohu 3812 cameras mounted 90 deg apart move on a separate translation system which allows for viewing of the sample in the transparent hot zone and gradient zone independent of the furnace translation rate and direction. Translation rates for both the cameras and furnace can be specified from 0.5micrometers/sec to 100 micrometers/sec with a stability of +/-5\%. The two furnaces share a Process Control Module (PCM) which controls the furnace hardware, a Data Acquisition Pad (DaqPad) which provides signal condition of thermal couple data, and two Cohu 3812 cameras. The hardware and software allow for real time monitoring and commanding of critical process control parameters. This paper will provide a detailed explanation of the SUBSA and PFMI systems along with performance data and some preliminary results from completed on-orbit processing runs.
Author
International Space Station; Spacecraft Instruments; Furnaces; Design Analysis; Systems Engineering

20030062151 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Maryland Univ., Greenbelt, MD, USA
Advancing Glaciological Applications of Remote Sensing with EO-1: (1) Mapping Snow Grain Size and Albedo on the Greenland Ice Sheet Using an Imaging Spectrometer, and (2) ALI Evaluation for Subtle Surface Topographic Mapping via Shape-from Shading
[2003]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9477; CU-1532627; No Copyright; Avail: CASI; A01, Hardcopy

The Hyperion sensor, onboard NASA's Earth Observing-1 (EO-1) satellite,is an imaging spectroradiometer with 220 spectral bands over the spectral range from 0.4 - 2.5 microns. Over the course of summer 2001, the instrument acquired

numerous images over the Greenland ice sheet. Our main motivation is to develop an accurate and robust approach for measuring the broadband albedo of snow from satellites. Satellite-derived estimates of broadband have typically been plagued with three problems: errors resulting from inaccurate atmospheric correction, particularly in the visible wavelengths from the conversion of reflectance to albedo (accounting for snow BRDE); and errors resulting from regression-based approaches used to convert narrowband albedo to broadband albedo. A typerspectral method has been developed that substantially reduces these three main sources of error and produces highly accurate estimates of snow albedo. This technique uses hyperspectral data from 0.98 - 1.06 microns, spanning a spectral absorption feature centered at 1.03 microns. A key aspect of this work is that this spectral range is within an atmospheric transmission window and reflectances are largely unaffected by atmospheric aerosols, water vapor, or ozone. In this investigation, we make broadband albedo measurements at four sites on the Greenland ice sheet: Summit, a high altitude station in central Greenland; the ETH/CU camp, a camp on the equilibrium line in western Greenland; Crawford Point, a site located between Summit and the ETH/CU camp; and Tunu, a site located in northeastern Greenland at 2000 m. altitude. Each of these sites has an automated weather station (AWS) that continually measures broadband albedo thereby providing validation data.
Derived from text
Ice; Remote Sensing; Glaciology; Albedo; Atmospheric Moisture; Imaging Spectrometers; Narrowband

20030062162 NASA Marshall Space Flight Center, Huntsville, AL, USA
The ATIC Long Duration Balloon Project
Guzik, T. G.; Adams, J. H.; Ahn, H. S.; Bashindzhagyan, G.; Chang, J.; Christl, M.; Fazely, A. R.; Ganel, O.; Granger, D.; Gunasingha, R., et al.; [2003]; 1 pp.; In English; 34th COSPAR Scientific Assembly/World Space Congress, 10-19 Oct. 2002, Houston, TX, USA
Report No.(s): PSBI-0048-02; Copyright; Avail: Other Sources; Abstract Only

Long Duration Balloon (LDB) scientific experiments, launched to circumnavigate the south pole over Antarctica, have particular advantages compared to Shuttle or other Low Earth Orbit (LEO) missions in terms of cost, weight, scientific 'duty factor' and work force development. The Advanced Thin Ionization Calorimeter (ATIC) cosmic ray astrophysics experiment is a good example of a university-based project that takes full advantage of current LDB capability. The ATIC experiment is currently being prepared for its first LDB science flight that will investigate the charge composition and energy spectra of primary cosmic rays over the energy range from about 10(exp 10) to 10(exp 14) eV. The instrument is built around a fully active, Bismuth Germanate (BGO) ionization calorimeter to measure the energy deposited by the cascades formed by particles interacting in a thick carbon target. A highly segmented silicon matrix, located above the target, provides good incident charge resolution plus rejection of the 'backscattered' particles from the interaction. Trajectory reconstruction is based on the cascade profile in the BGO calorimeter, plus information from the three pairs of scintillator hodoscope layers in the target section above it. A full evaluation of the experiment was performed during a test flight occurring between 28 December 2000 and 13 January 2001 where ATIC was carried to an altitude of approx. 37 km above Antarctica by an approx. 850,000 cu m helium filled balloon for one circumnavigation of the continent. All systems behaved well, the detectors performed as expected, more than 43 gigabytes of engineering and cosmic ray event data was returned and these data are now undergoing preliminary data analysis. During the coming 2002-2003 Antarctica summer season, we are preparing for a ATIC science flight with approx. 15 to 30 days of continuous data collection in the near-space environment of LDB float altitudes.
Author
Balloons; Balloon-Borne Instruments; Antarctic Regions; Calorimeters

20030062209 Biopac Systems, Inc., Santa Barbara, CA, USA
Students as Signal Sources in the Biomedical Engineering Laboratory
Macy, Alan J.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411816; No Copyright; Avail: CASI; A01, Hardcopy

Laboratory courses are used throughout Biomedical Engineering curriculum to give students hands-on, practical experience in scientific, computing and engineering methods. Interest in student-driven, inquiry-based labs has resulted in the availability of new teaching equipment for the exploration of biological systems and physiological processes. The movement to student-driven, inquiry-based labs is rooted in the belief that students will improve their critical thinking skills, achieve a greater understanding of processes explored in the lab and experience reduced frustration when gathering data. New teaching equipment allows for relatively easy collection of real-time physiological data: ECG, EEG, EMG, EOG (eye movement), pulse, skin temperature, respiration (flow and volume), limb and joint motion (distance, velocity and acceleration), electrodermal activity and response, muscle strength. New teaching equipment can aid the transition from instructor-dictated to student-driven laboratories. As students collect data directly from their own bodies, the process therein will stimulate their

curiosity and give them more control over their own learning by allowing them to test and retest to more fully understand the steps involved in scientific inquiry. Student-driven laboratory settings can increase student understanding of biomedical engineering principles as well as increase student appreciation of the scientific process.
DTIC
Physiological Effects; Electroencephalography; Medical Science

20030062289 Air Force Test Pilot School, Edwards AFB, CA
Collection of Video Images and Navigation Data for Use in a Kalman Filter and Evaluation of Video Images for Post-Flight Mission Reconstruction
Giebner, Michael G.; Peris, William E.; Havasy, Charles K.; Bilger, Jean; Janney, Clifton G.; Dec. 2002; 40 pp.; In English
Report No.(s): AD-A412001; AFFTC-TIM-02-08; No Copyright; Avail: CASI; A03, Hardcopy

The primary purpose of this project was to collect navigation and video data for use in a navigational Kalman filter. The secondary purpose of this project was to gather and analyze in-flight video images for post-flight mission reconstruction and terrain feature recognition. The test was flown in a T-38 aircraft modified with a GPS-aided inertial navigation reference system, Ashtech GPS receiver, two video cameras, a video recorder, and a cockpit video display. The primary test objective to collect navigation and video data was met. The secondary test objective to collect and analyze in-flight video images for post-flight reconstruction and terrain feature recognition also was met. Video data were recorded from both the forward-looking and side-looking cameras and comments and ratings were collected from the pilots as to the quality of the cameras' day-night imaging capability under normal and anti-blooming technology. Thirteen sorties were flown, including low altitude flights over land (day, night, near sunrise, near sunset) and over water (day, night, and near sunset); high altitude flights (day and night) over land and over water; air-to-air tactical maneuvering; and level flight over a target board (day, night, near sunrise, and near sunset). In addition, the ability of the cameras to detect a ground-based infrared beacon during flight was evaluated. Results showed that the cameras were marginally useful for terrain feature recognition (rated 3 on a scale of 1 to 5 with 5 being the best) and largely useful for mission reconstruction (rated 4 on a scale of 1 to 5 with 5 being the best). This test was conducted as a joint venture between U.S. Air Force TPS, Ball Aerospace & Technologies Corporation, Vision Systems International, and the Air Force Institute of Technology. (8 tables, 14 figures, 4 refs.)
DTIC
Image Processing; Kalman Filters; Cameras; Photomapping; Terrain Analysis; Video Tape Recorders

20030062753 Moscow State Univ., Russia
Experience of Application of Silicon Matrix as a Charge Detector in the ATIC Experiment
Zatsepin, V. I.; Adams, J. H.; Christl, M. J.; January 2003; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The Advanced Thin Ionization Calorimeter (ATIC) was built for series of long-duration balloon flights in Antarctica. Its main goal is to measure energy spectra of cosmic ray nuclei from protons up to iron nuclei in the wide range of their energy from 30 GeV up to 100 TeV. The ATIC balloon experiment had its first, test flight that lasted for 16 days from 28 Dec 2000 to 13 Jan 2001 around the South Pole. The ATIC spectrometer consists of a fully active BGO calorimeter, scintillator hodoscopes and a silicon matrix. The silicon matrix consisted of 4480 pixels was used as a charge detector in the experiment. About 25 million cosmic ray events were detected during the flight. In the paper, the charge spectrum obtained with the silicon matrix is analyzed.
Author
Cosmic Rays; Signal Detectors; Ceramic Matrix Composites; Silicon; Balloon-Borne Instruments; Energy Spectra; Spectrum Analysis

20030062769 Defence Research and Development Canada, Ottawa, Ontario, Canada
A Target Simulation for Studies of Radar Detection in Clutter
Thomson, Alan D.; Oct. 2002; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412159; DRDC-TR-2002-145; No Copyright; Avail: CASI; A04, Hardcopy

This report describes a high-fidelity simulation of the received signals produced by a low pulse repetition frequency shipborne pulsed Doppler radar when observing a sea-skimming anti-ship missile moving through precipitation above the sea. The simulation was designed as a component of a larger simulation aimed at determining the detection performance of radar operating in clutter conditions. The modeled radar system uses a phased array antenna and has the ability to vary the parameters of the transmitted waveform from burst to burst. The output of the simulation is designed for combination with the output of clutter and signal processor simulations so that target detection in clutter can be examined. A complete

description of the physical models used in the simulation and their mathematical implementation is presented. Example output data were used to derive propagation factor values, which were then compared with the output of the TERPEM commercial software package. Received power values also were derived from the example data and compared with the output of a multifunction radar simulator (ADAPT_MFR). Good agreement between the data sets was achieved, except for expected differences found at ranges near the radar horizon ('intermediate region'). The simulation is capable of producing realistic and useful signals for target detection studies, but it is recommended that it be integrated with the commercial software package TERPEM so that its applicability can be extended to any range near or beyond the radar horizon and to any atmospheric structure. Nevertheless, the favorable comparisons in the interference region demonstrate that this simulation is accurate, where applicable, and that it can be used with confidence for its stated purpose of assessing radar detection performance in clutter. (5 tables, 20 figures, 27 refs.)
DTIC
Signal Processing; Computerized Simulation; Antiship Missiles; Surface To Surface Missiles; Atmospheric Moisture; Target Recognition; Radar Echoes

20030062773 Izmir Inst. of Tech., Izmir, Turkey
Determination of Dose Profile Data With Film Dosimetry
Gokce, Tuncay C.; Aytac, Sitki; Gokce, Tumay; 25 Oct. 2001; 3 pp.; In English
Report No.(s): AD-A412055; No Copyright; Avail: CASI; A01, Hardcopy

Almost all external radiotherapy planning systems use dose profile data. There are various methods to measure these profiles. Direct measurements with semiconductor detectors are widely used. But this method takes lots of time especially at linear accelerators. We developed a simple method for this purpose. Dose profiles are measured with using radiographic films and verification films. Suitable modifications are done with derived sensitometric curve. Results are compared with original profiles. For the Co60, this method is found as an alterative to other methods with acceptable accuracy (% +/- 2).
DTIC
Radiography; Dosimeters; Dosage; Radiation Therapy

20030062815 Florida Inst. of Tech., Melbourne, FL, USA
Development of a Hydrazine/Nitrogen Dioxide Fiber Optic Sensor
Baum, J. Clayton; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 1-10; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A simple, low cost fiber optic sensor is described for the simultaneous vapor phase detection of hydrazines and nitrogen dioxide. The device utilizes an acid-base indicator that undergoes color changes depending on which gas is present. The indicator is imbedded in a hydrogel matrix to aid long-term stability. The sensor responds in less than one minute to hydrazine (50 ppm) and nitrogen dioxide (400 ppm). Stabiiity over times greater than several days remains to be tested. The sensor should be ideal for long-term detection of leaks in propulsion systems utilizing hypergolic propellants especially since explosion hazard due to spark is a concern.
Author
Fiber Optics; Gas Detectors; Hydrazines; Nitrogen Dioxide

20030062817 Florida Inst. of Tech., FL, USA
Remote Leak Detection: Indirect Thermal Technique
Clements, Sandra; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 47-58; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Remote sensing technologies are being considered for efficient, low cost gas leak detection. Eleven specific techniques have been identified for further study and evaluation of several of these is underway. The Indirect Thermal Technique is one of the techniques that is being explored. For this technique, an infrared camera is used to detect the temperature change of a pipe or fitting at the site of a gas leak. This temperature change is caused by the change in temperature of the gas expanding from the leak site. During the 10-week NFFP program, the theory behind the technique was further developed, experiments were performed to determine the conditions for which the technique might be viable, and a proof-of-concept system was developed and tested in the laboratory.
Author
Leakage; Gas Detectors; Remote Sensing

20030062823 Oklahoma Baptist Univ., Shawnee, OK, USA
Instrumentation and Methodology Development for Mars Mission
Chen, Yuan-Liang Albert; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 39-46; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Mars environment comprises a dry, cold and low air pressure atmosphere with low gravity (0.38g) and high resistivity soil. The global dust storms that cover a large portion of Mars were observed often from Earth. This environment provides an idea condition for triboelectric charging. The extremely dry conditions on the Martian surface have raised concerns that electrostatic charge buildup will not be dissipated easily. If triboelectrically generated charge cannot be dissipated or avoided, then dust will accumulate on charged surfaces and electrostatic discharge may cause hazards for future exploration missions. The low surface temperature on Mars helps to prolong the charge decay on the dust particles and soil. To better understand the physics of Martian charged dust particles is essential to future Mars missions. We research and design two sensors, velocity/charge sensor and PZT momentum sensors, to detect the velocity distribution, charge distribution and mass distribution of Martian charged dust particles. These sensors are fabricated at NASA Kenney Space Center, Electromagnetic Physics Testbed. The sensors will be tested and calibrated for simulated Mars atmosphere condition with JSC MARS-1 Martian Regolith simulant in this NASA laboratory.
Author
Mars Environment; Electrostatic Charge; Velocity Measurement; Dust; Charge Distribution; Mass Distribution

20030062971 Texas A&M Univ., College Station, TX, USA
Scanning Microwave Induced Acoustic Tomography
Wang, Lihong; Oct. 2002; 39 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0455
Report No.(s): AD-A411511; No Copyright; Avail: CASI; A03, Hardcopy

Since October 2001, we have published three peer-reviewed journal articles in IEEE Transactions on Medical imaging a top imaging journal, published one conference proceedings article, and delivered 9 invited talks. The combination of ultrasound and microwave has provided us a unique opportunity for early-cancer imaging with high resolution and high contrast. We have made significant technical progress in thermoacoustic imaging including data acquisition and imaging reconstruction. Specifically, our accomplishments include (1) an exact and an approximate time-domain reconstruction algorithm for thermoacoustic tomography in a spherical geometry was derived and published, (2) an exact frequency-domain reconstruction algorithm for thermoacoustic tomography in a planar geometry was derived and published, (3) an exact frequency-domain reconstruction algorithm for thermoacoustic tomography in a cylindrical geometry was derived and published, and (4) high- resolution and high-contrast images were obtained and published. The reconstruction is an inverse source problem similar to that in PET (positron emission tomography); however, the reconstruction in PET is based on geometric optics whereas the reconstruction in thermoacoustic imaging is based on diffractive/wave optics. We have successfully imaged biological tissue with high resolution and high contrast. We will advance this
DTIC
Data Acquisition; Medical Services; Mammary Glands; Cancer

20030062974 Observatoire de la Cote d'Azur, Caussols, France
The Construction of a Multi CCD Camera
Maury, Alain; January 1996; 21 pp.; In English
Contract(s)/Grant(s): F61708-93-W0889
Report No.(s): AD-A411575; SPC-93-4007; EOARD-SPC-93-4079; No Copyright; Avail: CASI; A03, Hardcopy

Sky surveillance projects require the largest possible sky coverage. Doing so with a given image sampling (number of arc seconds per pixels) and a given telescope require the largest possible detector. There are three ways of installing large charge coupled device (CCD) detectors at the focus of a telescope: (1) use a single intrinsically large detector; (2) build a large CCD matrix using buttable devices; or (3) build a multi-CCD camera, provided the field of view of the telescope is large enough. The final solution is the one on which the authors have worked for the last 2 years, i.e. placing several individual CCDs in a large focal plane to recreate a single continuous image using multiple exposures. With the Sloan Digital Sky Survey project, which used 30 2K devices in great circle scanning, 2 exposures were required to produce a continuous image of the sky. In this case, taking into account the specificity of the telescope (a 30x30 cm curved field of view), the authors thought that using 9 2K CCDs to create a pseudo array 5 degrees high would be the most cost-effective solution. The general arrangement of this array has been described elsewhere (the OCA CCD controller). The development of the multi-CCD controller took more time than expected, as did the development of the required detection software. When an initial system

started to work, regular observations started to take a substantial part of the authors' time. Nevertheless, between the time this contract was awarded and today, several projects were undertaken to further the construction of such a multi-CCD camera. While it is likely that the authors are going to replace their current 2K device with a larger 4K device or a 7Kx9K one, they believe the technology development they did around this idea was valuable. It is noted that a single 7Kx9K device covers almost the area of 10 2K CCDs, and both its installation and use at the telescope is easier than using 9 individual chips. (11 figures)
DTIC
Space Surveillance; Telescopes; Charge Coupled Devices; Night Vision; Goggles

20030062991 NASA Langley Research Center, Hampton, VA, USA
TEPC Response Functions
Shinn, J. L.; Wilson, J. W.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 241-260; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The tissue equivalent proportional counter had the purpose of providing the energy absorbed from a radiation field and an estimate of the corresponding linear energy transfer (LET) for evaluation of radiation quality to convert to dose equivalent. It was the recognition of the limitations in estimating LET which lead to a new approach to dosimetry, microdosimetry, and the corresponding emphasis on energy deposit in a small tissue volume as the driver of biological response with the defined quantity of lineal energy. In many circumstances, the average of the lineal energy and LET are closely related and has provided a basis for estimating dose equivalent. Still in many cases the lineal is poorly related to LET and brings into question the usefulness as a general purpose device. These relationships are examined in this paper.
Author
Proportional Counters; Linear Energy Transfer (Let); Radiation Distribution; Physiological Responses; Tissues (Biology); Ionizing Radiation

20030063003 NASA Langley Research Center, Hampton, VA, USA
Summary of Atmospheric Ionizing AIR Research: SST-Present
Wilson, J. W.; Goldhagen, P.; Rafnsson, V.; deAngelis, G.; Friedberg, W.; Clem, J. M.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 387-407; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Supersonic Transport (SST) program, proposed in 1961, first raised concern for the exposure of pregnant occupants by solar energetic particles (SEP), and neutrons were suspected to have a main role in particle propagation deep into the atmosphere. An eight-year flight program confirmed the role of SEP as a significant hazard and of the neutrons as contributing over half of the galactic cosmic ray (GCR) exposures, with the largest contribution from neutrons above 10 MeV. The FAA Advisory Committee on the Radiobiological Aspects of the SST provided operational requirements. The more recent lowering of the radiation exposure limits by the International Commission on Radiological Protection with the classification of aircrew as radiation workers renewed interest in GCR background exposures at commercial flight altitudes and stimulated epidemiological studies in Europe, Japan, Canada and the USA. The proposed development of a High Speed Civil Transport (HSCT) required validation of the role of high-energy neutrons, and this resulted in ER-2 flights at solar minimum (June 1997) and studies on effects of aircraft materials on interior exposures. Recent evaluation of health outcomes of DOE nuclear workers resulted in legislation for health compensation in year 2000 and recent European aircrew epidemiological studies of health outcomes bring renewed interest in aircraft radiation exposures. As improved radiation models become available, it is imperative that a corresponding epidemiological program of US aircrew be implemented.
Author
Supersonic Transports; Energetic Particles; Atmospheric Radiation; Ionizing Radiation; Civil Aviation

20030063020 College of William and Mary, Williamsburg, VA, USA
High Resolution Spectroscopy to Support Atmospheric Measurements
Venkataraman, Malathy Devi; [2003]; 13 pp.; In English
Contract(s)/Grant(s): NCC1-390; NCC1-301521; No Copyright; Avail: CASI; A03, Hardcopy

Spectroscopic parameters (such as line position, intensity, broadening and shifting coefficients and their temperature dependences, line mixing coefficients etc.) for various molecular species of atmospheric interest are determined. In order to achieve these results, infrared spectra of several molecular bands are obtained using high-resolution recording instruments

such as tunable diode laser spectrometer and Fourier transform spectrometers. Using sophisticated analysis routines (Multispectrum nonlinear least squares technique) these high-resolution infrared spectra are processed to determine the various spectral line parameters that are cited above. Spectra were taken using the McMath-Pierce Fourier transform spectrometer (FTS) at the National Solar Observatory on Kitt Peak, Arizona as well as the Bruker FTS at the Pacific Northwest National Laboratory (PNNL) at Richland, Washington. Most of the spectra are acquired not only at room temperature, but also at several different cold temperatures. This procedure is necessary to study the variation of the spectral line parameters as a function of temperature in order to simulate the Earth's and other planetary atmospheric environments. Depending upon the strength or weakness of the various bands recorded and analyzed, the length(s) of the absorption cells in which the gas samples under study are kept varied from a few centimeters up to several meters and the sample temperatures varied from approximately +30 C to -63 C. Research on several infrared bands of various molecular species and their isotopomers are undertaken. Those studies are briefly described.
Derived from text
Fourier Transformation; High Resolution; Atmospheric Chemistry; Atmospheric Composition; Laser Spectrometers; Molecular Spectroscopy

20030063040 NASA Marshall Space Flight Center, Huntsville, AL, USA, Lockheed Martin Michoud Space Systems, USA
Thermographic Inspection of Aerospace Tankage
Bouvier, Carl; Russell, Samuel; Walker, James; Wilkerson, Chuck; [2003]; 1 pp.; In English; American Society for Nondestructive Testing 12th Annual Research Symposium, Mar. 2003, Orlando, FL, USA
Contract(s)/Grant(s): NCC8-191; No Copyright; Avail: Other Sources; Abstract Only

Thermography has been shown to be the ideal technical and economic inspection method for two applications - post-machining evaluations and for field inspections of damage and repair. For most manufacturing applications ultrasonic inspections are already available and established. There is no question about the detectability or cost when inspecting hardware out of the autoclave. But when the part is too large to bring to the scanning inspection system or you do not want to remove the hardware from its current setup then a more portable or field applicable inspection is required. This paper will describe two applications of thermography on composite inspections. The NASA NDE Team and Lockheed Martin conducted the work at NASA s George C. Marshall Space Flight Center (MSFC). The first application was inspecting machined hardware. The technique and example data will be presented along with the advantages of thermography. Examples of drilling holes and trimming the edges will be discussed. The second application will be the evaluation of damage in a composite part and the subsequent repair of the region will be presented. The technique, data, and benefits of this application will also be presented along with the follow-up inspection of the post- repaired hardware.
Author
Thermography; Inspection; Nondestructive Tests; Detection

20030063056 Virginia Univ., Charlottesville, VA
Acquisition of a High-Resolution Field Emission Electron Microscope for Nanoscale Materials Research and Development
FitzGerald, James M.; Jul. 2002; 14 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0420
Report No.(s): AD-A411490; AFRL-SR-AR-TR-03-0039; No Copyright; Avail: CASI; A03, Hardcopy

Funds are requested for the purchase of a quantitative field emission gun (FEG) scanning electron microscope (SEM) at the University of Virginia (UVa). This quantitative microscope will contain a 25 kV Schottky FEG, energy dispersive x-ray spectrometer (EDS), in-situ nano-lithography system, chemical mapping and orientation imaging and strain analysis capabilities. The instrument will allow quantitative imaging and compositional analyses to be performed on all types of materials with high spatial resolution at low accelerating voltages (< 2.5 nm at 1 keV, for example), and it is essential for many current materials research programs within the School of Engineering and Applied Science (SEAS) at UVa. The increased resolution that a FEG SEM delivers will be a centerpiece for future research and development and characterization of nanoscale materials ranging from metals, electronic, and biological materials within SEAS and the College of Arts and Sciences, as well as for nearby academic institutions and industries. The new microscope is required to replace the existing SEMs, which are seriously outdated. It is clear that the new state-of-the-art SEM is required as a starting base in order to develop new materials in the nanoscale class that the DoD and the rest of the research community are pushing towards. The current SEMs have effectively served UVa in an efficient manner, providing over 15 years of continuous use for materials research. UVa has faculty and staff with sufficient expertise in SEM techniques to ensure that the new instrument is utilized for the highest quality materials research and that it is maintained at an optimum level of performance. The current track record

that UVa has with other analytical instruments in the past are a strong testament to this infrastructure and we are confident this will continue in the future.
DTIC
Scanning Electron Microscopy; Composite Materials; High Resolution; Field Emission; Electron Microscopes

20030063122 NASA Ames Research Center, Moffett Field, CA, USA
Interleaved Observation Execution and Rescheduling on Earth Observing Systems
Khatib, Lina; Frank, Jeremy; Smith, David; Morris, Robert; Dungan, Jennifer; [2003]; 5 pp.; In English; ICAPS 2003 Workshop on Plan Execution, Jun. 2003; No Copyright; Avail: CASI; A01, Hardcopy

Observation scheduling for Earth orbiting satellites solves the following problem: given a set of requests for images of the Earth, a set of instruments for acquiring those images distributed on a collecting of orbiting satellites, and a set of temporal and resource constraints, generate a set of assignments of instruments and viewing times to those requests that satisfy those constraints. Observation scheduling is often construed as a constrained optimization problem with the objective of maximizing the overall utility of the science data acquired. The utility of an image is typically based on the intrinsic importance of acquiring it (for example, its importance in meeting a mission or science campaign objective) as well as the expected value of the data given current viewing conditions (for example, if the image is occluded by clouds, its value is usually diminished). Currently, science observation scheduling for Earth Observing Systems is done on the ground, for periods covering a day or more. Schedules are uplinked to the satellites and are executed rigorously. An alternative to this scenario is to do some of the decision-making about what images are to be acquired on-board. The principal argument for this capability is that the desirability of making an observation can change dynamically, because of changes in meteorological conditions (e.g. cloud cover), unforeseen events such as fires, floods, or volcanic eruptions, or un-expected changes in satellite or ground station capability. Furthermore, since satellites can only communicate with the ground between 5\% to 10\% of the time, it may be infeasible to make the desired changes to the schedule on the ground, and uplink the revisions in time for the on-board system to execute them. Examples of scenarios that motivate an on-board capability for revising schedules include the following. First, if a desired visual scene is completely obscured by clouds, then there is little point in taking it. In this case, satellite resources, such as power and storage space can be better utilized taking another image that is higher quality. Second, if an unexpected but important event occurs (such as a fire, flood, or volcanic eruption), there may be good reason to take images of it, instead of expending satellite resources on some of the lower priority scheduled observations. Finally, if there is unexpected loss of capability, it may be impossible to carry out the schedule of planned observations. For example, if a ground station goes down temporarily, a satellite may not be able to free up enough storage space to continue with the remaining schedule of observations. This paper describes an approach for interleaving execution of observation schedules with dynamic schedule revision based on changes to the expected utility of the acquired images. We describe the problem in detail, formulate an algorithm for interleaving schedule revision and execution, and discuss refinements to the algorithm based on the need for search efficiency. We summarize with a brief discussion of the tests performed on the system.
Author
Earth Observations (From Space); Observation Scheduling; Images; Earth (Planet); Algorithms

20030063142 Satlantic, Inc., Halifax, Nova Scotia, Canada
Ocean Color Radiometry from Aircraft: I. Low Altitude Measurements from Light Aircraft
Lazin, Gordana; Harding, Lawrence W.; McLean, Scott; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume VI: Special Topics in Ocean Optics Protocols and Appendices; April 2003, pp. 79-85; In English; See also 20030063139; No Copyright; Avail: CASI; A02, Hardcopy

Low altitude, passive remote sensing of ocean color from aircraft spans nearly three decades and has used a variety of sensors. The Multichannel Ocean Color Sensor (MOCS) was first used in field experiments in 1980-82. MOCS measured spectral radiances in twenty contiguous 15-nm wide bands from 400 to 700 nm. Early applications of a spectral curvature ocean color algorithm for chlorophyll a concentration, Chl [mg/cu m], used data from MOCS along the East coast of the US over a six-year period. The spectral curvature algorithm was applied in real-time without calibration to estimate Chl. MOCS was operated with the Airborne Oceanographic Lidar (AOL) that combined active and passive radiometry and produced independent estimates of Chl. Study sites for the comparisons included shelf waters of the western Atlantic Ocean, Chesapeake Bay, Nantucket Shoals, and warm-core Gulf Stream rings. MOCS- and AOL-derived chl-a and in-situ measurements of chl-a from ships showed good agreement. The successful retrieval of Chl using MOCS data and the spectral curvature algorithm led to the development of a small and relatively simple ocean color instrument, the Ocean Data Acquisition System (ODAS) in the mid-1980s, supported by NASA and NOAA. Following on the findings of Grew (1981) and Campbell and Esaias (1983) using equally spaced bands around MOCS band 7, ODAS was designed with three bands in the blue-green region of the visible

spectrum at 460, 490, and 520 nm. The instrument was specifically designed for missions on light aircraft, an attribute rare, or absent, in previous ocean color instruments. The goal was to enable repeat coverage with high spatial resolution on affordable, relatively slow flying platforms, thus to move from demonstration to operational mode in acquiring remotely sensed data on Chl in estuarine and coastal waters. The ODAS nadir-viewing radiance sensor was designed to collect data along a line-of-flight at a sampling rate of 10 Hz. It was equipped with Loran-C for onboard navigation and was usually flown together with an infrared temperature sensor (PRT-5 or Heimann instruments) to sample sea surface temperature (SST) concurrently with ocean color measurements. The early uses of ODAS were in waters of the middle Atlantic bight, and it subsequently received heavy use from 1989-96 in Chesapeake Bay as part of the Chesapeake Bay Remote Sensing Program (CBRSP http://www.cbrsp.org). Nearly 150 flights were conducted with ODAS to study seasonal and inter-annual variability of phytoplankton biomass and primary productivity in the Bay.
Author
Radiometers; Low Altitude; Remote Sensing; Ocean Data Acquisitions Systems; Water Color

20030063143 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Stray-Light Correction of the Marine Optical Buoy
Brown, Steven W.; Johnson, B. Carol; Flora, Stephanie J.; Feinholz, Michael E.; Yarbrough, Mark A.; Barnes, Robert A.; Kim, Yong Sung; Lykke, Keith R.; Clark, Dennis K.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume VI: Special Topics in Ocean Optics Protocols and Appendices; April 2003, pp. 87-126; In English; See also 20030063139; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

In ocean-color remote sensing, approximately 90\% of the flux at the sensor originates from atmospheric scattering, with the water-leaving radiance contributing the remaining 10\% of the total flux. Consequently, errors in the measured top-of-the atmosphere radiance are magnified a factor of 10 in the determination of water-leaving radiance. Proper characterization of the atmosphere is thus a critical part of the analysis of ocean-color remote sensing data. It has always been necessary to calibrate the ocean-color satellite sensor vicariously, using in situ, ground-based results, independent of the status of the pre-flight radiometric calibration or the utility of on-board calibration strategies. Because the atmosphere contributes significantly to the measured flux at the instrument sensor, both the instrument and the atmospheric correction algorithm are simultaneously calibrated vicariously. The Marine Optical Buoy (MOBY), deployed in support of the Earth Observing System (EOS) since 1996, serves as the primary calibration station for a variety of ocean-color satellite instruments, including the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), the Moderate Resolution Imaging Spectroradiometer (MODIS), the Japanese Ocean Color Temperature Scanner (OCTS) , and the French Polarization and Directionality of the Earth's Reflectances (POLDER). MOBY is located off the coast of Lanai, Hawaii. The site was selected to simplify the application of the atmospheric correction algorithms. Vicarious calibration using MOBY data allows for a thorough comparison and merger of ocean-color data from these multiple sensors.
Derived from text
Ocean Color Scanner; Remote Sensing; Data Processing; Buoys; Optical Properties; Ocean Data Acquisitions Systems; Protocol (Computers); Applications Programs (Computers); Spectrographs

20030063144 Monterey Bay Aquarium Research Inst., Moss Landing, CA, USA
Radiometric and Bio-optical Measurements from Moored and Drifting Buoys: Measurement and Data Analysis Protocols
Kuwahara, Victor S.; Strutton, P. G.; Dickey, T. D.; Abbott, M. R.; Letelier, R. M.; Lewis, M. R.; McLean, S.; Chavez, F. P.; Barnard, A.; Morrison, J. Ruairidh, et al.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume VI: Special Topics in Ocean Optics Protocols and Appendices; April 2003, pp. 35-79; In English; See also 20030063139; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this chapter is to describe protocols covering: (1) Strategic principles for the location and deployment duration of moored instrument arrays, and for numbers, locations and frequency of deploying instrumented drifting buoys, to augment satellite ocean color imagery and shipboard sampling (or vice versa) in studies of mesoscale and regional scale oceanographic phenomena; (2) State of the art design and fabrication of bio-optical moored and drifting data buoys; (3) Methods for maintaining and operating moored instrument arrays, including: a. Mooring deployment b. Periodic maintenance during deployments and replacement of moorings and instruments; (4) System operation methods, including: a. Instrumentation b. Bio-fouling avoidance and mitigation c. On-board autonomous instrument operations, data acquisition, data storage, sampling schedules, time base methods (e.g. GPS on on-board clock), and time synchronization of data records from multiple instruments. d. On-board data processing and near-real-time data communications e. Platform geo-location, for tracking drifting buoys, and as a safety measure should a mooring come adrift; (5) Methods of data processing, quality control

and analysis; (6) Data archival and retrieval. The chapter concludes with insights into future directions for the design and applications of moored and drifting bio-optical buoys, together with satellite ocean color imagery, in studies of oceanographic biogeochemical phenomena.
Author
Ocean Data Acquisitions Systems; Buoys; Instrument Packages; Data Acquisition; Calibrating; Measuring Instruments; Standards; Quality Control

20030063145 National Environmental Satellite Service, Suitland, MD, USA
MOBY, A Radiometric Buoy for Performance Monitoring and Vicarious Calibration of Satellite Ocean Color Sensors: Measurement and Data Analysis Protocols, Chapter 2
Clark, Dennis K.; Yarbrough, Mark A.; Feinholz, Mike; Flora, Stephanie; Broenkow, William; Kim, Yong Sung; Johnson, B. Carol; Brown, Steven W.; Yuen, Marilyn; Mueller, James L.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation. Volume 6: Special Topics in Ocean Optics Protocols and Appendices; April 2003, pp. 3-34; In English; See also 20030063139; Original contains black and white illustrations
Contract(s)/Grant(s): NASA Order S-41365-F; NASA Order S-64096-E; CCG-98-439; NOAA-NA-00AANEG0072; No Copyright; Avail: CASI; A03, Hardcopy

The Marine Optical Buoy (MOBY) is the centerpiece of the primary ocean measurement site for calibration of satellite ocean color sensors based on independent in situ measurements. Since late 1996, the time series of normalized water-leaving radiances L(sub WN)(lambda) determined from the array of radiometric sensors attached to MOBY are the primary basis for the on-orbit calibrations of the USA Sea-viewing Wide Field-of-view Sensor (SeaWiFS), the Japanese Ocean Color and Temperature Sensor (OCTS), the French Polarization Detection Environmental Radiometer (POLDER), the German Modular Optoelectronic Scanner on the Indian Research Satellite (IRS1-MOS), and the USA Moderate Resolution Imaging Spectrometer (MODIS). The MOBY vicarious calibration L(sub WN)(lambda) reference is an essential element in the international effort to develop a global, multi-year time series of consistently calibrated ocean color products using data from a wide variety of independent satellite sensors. A longstanding goal of the SeaWiFS and MODIS (Ocean) Science Teams is to determine satellite-derived L(sub WN)(labda) with a relative combined standard uncertainty of 5 %. Other satellite ocean color projects and the Sensor Intercomparison for Marine Biology and Interdisciplinary Oceanic Studies (SIMBIOS) project have also adopted this goal, at least implicitly. Because water-leaving radiance contributes at most 10 % of the total radiance measured by a satellite sensor above the atmosphere, a 5 % uncertainty in L(sub WN)(lambda) implies a 0.5 % uncertainty in the above-atmosphere radiance measurements. This level of uncertainty can only be approached using vicarious-calibration approaches as described below. In practice, this means that the satellite radiance responsivity is adjusted to achieve the best agreement, in a least-squares sense, for the L(sub WN)(lambda) results determined using the satellite and the independent optical sensors (e.g. MOBY). The end result of this approach is to implicitly absorb unquantified, but systematic, errors in the atmospheric correction, incident solar flux, and satellite sensor calibration into a single correction factor to produce consistency with the in situ data.
Author
Ocean Data Acquisitions Systems; Buoys; Ocean Color Scanner; Calibrating; Protocol (Computers); Data Transmission; Optical Measuring Instruments; Data Processing

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20030062143 Chungnam National Univ., Korea, Republic of
The Light Propagation in Biological Tissue for Cancer Treatment
Lim, H. S.; Lee, D. J.; Kim, J. M.; Kim, S. H.; Oct. 25, 2001; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412086; No Copyright; Avail: CASI; A01, Hardcopy

This paper is to study the accessible depth by photons within biological tissue for Photodynamic Therapy of cancer. For the measurements of light propagation within tissue, we applied the diode Laser of 660nm wavelength and by assuming the

medium to be homogeneous, we neglect the effects of any refractive index mismatches between the tissue layers. The result have yielded the penetration depth of light within biological tissue.
DTIC
Optical Properties; Lasers; Light Transmission; Cancer; Radiation Therapy; Tissues (Biology); Photometers; Diodes

20030062206 Keio Univ., Tokyo
Fluorescence Image Analysis for Quantification of Active Oxygen Induced by Photochemical Reaction
Takahashi, M.; Nagao, T.; Imazeki, Y.; Matsuzaki, K.; Minamitani, H.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411786; No Copyright; Avail: CASI; A01, Hardcopy

This study was performed to confirm that activated leukocytes are concerned with Vascular Shut Down effect VSD in PhotoDynamic Therapy PDT. Hydrogen per-oxide H202, which is a kind of active oxygen that came from monocytes, was made visibility under the confocal laser scanning microscope; CLSM, and tried to quantify the amount of its formation from the fluorescent intensity with image analysis. Fluorescence images acquired by CLSM were analyzed, and the fluorescence intensity was ex- pressed as gray level, which is graded from 0 to 255. Only the fluorescence derived from a monocyte added Zinc co- proporphyrin III ZnCP-III just before measurement and with HeNe laser irradiation caused fluorescence distribution move to increase as the time course, while no change of distribution was especially observed in other three conditions (only added Zn CP-III, only irradiated with HeNe laser, Non-treated). The result indicates that photochemical reaction occurred due to excitation of photosensitizer, and active oxygen derived from the reaction stimulated monocytes. The activated monocytes, this time for themselves, generated active oxygen and H202 was made visibility by dichlorofluorescin DCFH fluorescence method. In conclusion, we confirmed that activated monocytes by photochemical reaction are concerned with VSD effect.
DTIC
Fluorescence; Photochemical Reactions; Oxygen; Visibility; Leukocytes

20030062214 Arizona Univ., Tucson, AZ
Development of an All Solid-State Raman Image Amplifier
Powell, R. C.; Calmes, L. K.; Murray, J. T.; Nov. 25, 2002; 128 pp.; In English
Contract(s)/Grant(s): DAAG55-97-1-0331
Report No.(s): AD-A410896; No Copyright; Avail: CASI; A07, Hardcopy

This report describes a new type of eye-safe, range-gated lidar sensing element based on solid-state Raman image amplification (SSRIA) in a solid-state optical crystal. SSRIA can amplify low-level images in the eye-safe infrared at 1.556 microns with gains up to 106 with the addition of only quantum-limited noise. The high gains from SSRIA can compensate for low quantum efficiency detectors and can reduce the need for detector cooling. The range-gate of SSRIA is controlled by the pulse width of the pump laser and can be as short as 30 100 Cm, using pump pulses of 2 - 6.7 nsec FWHM. A rate equation theoretical model is derived to help in the design of short-pulsed Raman lasers. A theoretical model for the quantum noise properties of SSRIA is presented. SSRIA results in higher SNR images throughout a broad range of incident light levels, in contrast to the increasing noise factor with reduced gain in image intensified CCD's. A theoretical framework for the optical resolution of SSRIA is presented and it is shown that SSRIA can produce higher resolution than ICCD's.
DTIC
Laser Pumping; Images; Image Intensifiers; Infrared Radiation; Solid State Devices

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20030062027 Lockheed Martin Corp., USA
Space Shuttle ET Friction Stir Weld Machines
Thompson, Jack M.; [2003]; 11 pp.; In English; Aeromat 2003 Conference Exposition, 9-12 Jun. 2003, Dayton, OH, USA
Contract(s)/Grant(s): NAS8-00016; No Copyright; Avail: CASI; A03, Hardcopy

NASA and Lockheed-Martin approached the FSW machine vendor community with a specification for longitudinal barrel production FSW weld machines and a shorter travel process development machine in June of 2000. This specification was

based on three years of FSW process development on the Space Shuttle External Tank alloys, AL2 195-T8M4 and AL22 19-T87. The primary motivations for changing the ET longitudinal welds from the existing variable polarity Plasma Arc plasma weld process included: (1) Significantly reduced weld defect rates and related reduction in cycle time and uncertainty; (2) Many fewer process variables to control (5 vs. 17); (3) Fewer manufacturing steps; (4) Lower residual stresses and distortion; (5) Improved weld strengths, particularly at cryogenic temperatures; (6) Fewer hazards to production personnel. General Tool was the successful bidder. The equipment is at this writing installed and welding flight hardware. This paper is a means of sharing with the rest of the FSW community the unique features developed to assure NASA/L-M of successful production welds.
Author
Friction Stir Welding; Welded Joints; Welding Machines; Product Development; Structural Design; Design Analysis

20030062134 Illinois Univ., Chicago, IL, USA
Modified Involute Helical Gears: Computerized Design, Simulation of Meshing, and Stress Analysis
Handschuh, Robert, Technical Monitor; Litvin, Faydor L.; Gonzalez-Perez, Ignacio; Carnevali, Luca; Kawasaki, Kazumasa; Fuentes-Aznar, Alfonso; June 2003; 66 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2450; WBS 22-708-28-02; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/CR-2003-212229; E-13849; NAS 1.26:21229; ARL-CR-514; Copyright; Avail: CASI; A04, Hardcopy

The computerized design, methods for generation, simulation of meshing, and enhanced stress analysis of modified involute helical gears is presented. The approaches proposed for modification of conventional involute helical gears are based on conjugation of double-crowned pinion with a conventional helical involute gear. Double-crowning of the pinion means deviation of cross-profile from an involute one and deviation in longitudinal direction from a helicoid surface. Using the method developed, the pinion-gear tooth surfaces are in point-contact, the bearing contact is localized and oriented longitudinally, and edge contact is avoided. Also, the influence of errors of aligment on the shift of bearing contact, vibration, and noise are reduced substantially. The theory developed is illustrated with numerical examples that confirm the advantages of the gear drives of the modified geometry in comparison with conventional helical involute gears.
Author
Gear Teeth; Computer Aided Design; Stress Analysis

20030062850 Columbia Univ., New York, NY, USA
A Chemical Perspective to Strategy and Design of Nanoscale Materials: The Science Behind Nanotechnology
OBrien, Stephen P.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 257-284; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Several different technologies are being developed to build nanostructures with individual atoms and molecules as components, instead of scaling down existing methods of fabrication. Nanoporous silica can be formed from block copolymer templates. These templates enable self-assembly, which has analogs in nature. Ferroelectric nanostructures can be used in non-volatile memory. The presentation also describes the organization of nanotechnology research activities at Columbia University.
CASI
Nanostructures (Devices); Nanotechnology; Fabrication; Self Assembly; Ferroelectric Materials; Microporosity; Porous Materials

20030062852 California Polytechnic State Univ., San Luis Obispo, CA, USA
The Fundamentals of Variation: An Inexpensive and Elegant Experiment for Engineering Students
Vanasupa, Linda; Smith, Heather; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 353-360; In English; See also 20030062842; Original contains black and white illustrations
Contract(s)/Grant(s): NSF DUE-99-52609; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, an experiment is designed to demonstrate the reality of variation and to instruct students on how to compute its quantitative impact on the measurements results. The experiment is also aimed at getting the students to identify possible sources of variation, design means of minimizing the variation from the different sources and interpret the meaning of the resulting measured value. A prerequisite knowledge of the normal probability curve, the significance of its standard deviation,

a basic knowledge of conrol charts and mean values are requirements to better understand this experiment.
Derived from text
Statistical Analysis; Engineering; Precision; Dimensional Measurement; Variability

20030062855 Arizona State Univ., Tempe, AZ, USA
A Materials Concept Inventory for Introductory Materials Engineering Courses
Krause, Stephen; Decker, J. Chris; Niska, Justin; Alford, Terry; Griffin, Richard; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 413-424; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

An alpha version of a materials concept inventory (MCI) test has been created for the field of materials science and engineering and tested an alpha version. To create the test, an extensive literature survey of current assessment tools in science, math, and engineering disciplines. A substantial program to solicit student feedback was initiated including weekly short answer and multiple choice quizzes as well as weekly interviews. Once the Materials Concept Inventory was created it was administered to a summer session of the introductory materials course of 13 students. At the end of the summer session it was again administered to the 12 people still in the class. The data from these two tests were then assessed and reported in this paper.
Derived from text
Materials Science; Education; Mathematics; Mechanical Engineering

20030062856 NASA Ames Research Center, Moffett Field, CA, USA
Composite Bear Canister
Chung, W. Richard; Jara, Steve; Suffel, Susan; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 491-493; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

To many national park campers and mountain climbers saving their foods in a safe and unbreakable storage container without worrying being attacked by a bear is a challenging task. In some parks, the park rangers have mandated that park visitors rent a bear canister for their food storage. Commercially available bear canisters are made of ABS plastic, weigh 2.8 pounds, and have a 180 cubic inch capacity for food storage. A new design with similar capacity was conducted in this study to reduce its weight and make it a stiffer and stronger canister. Two prototypes incorporating carbon prepreg with and without honeycomb constructions were manufactured using hand lay-up and vacuum bag forming techniques. A 6061-T6-aluminum ring was machined to dimensions in order to reinforce the opening area of the canister. Physical properties (weight and volume) along with mechanical properties (flexural strength and specific allowable moment) of the newly fabricated canisters are compared against the commercial ones. The composite canister weighs only 56\% of the ABS one can withstand 9 times of the force greater. The advantages and limitations of using composite bear canisters will be discussed in the presentation.
Author
Cans; Fabrication; Plastics; Mechanical Properties; Physical Properties; Composite Structures

20030062864 Akron Univ., Akron, OH, USA
A Simple But Effective Experiment to Illustrate Second Order Dynamic Systems
Song, Gang-Ding; Zeng, Ming; Lam, Paul C.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 107-115; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A vibration experiment is built to demonstrate mechanical resonance of second order dynamic systems for mechanical engineering students who are taking System Dynamics and Responses. This vibration experiment employs a platform subjected to sinusoidal input force via a DC motor. By employing three underdamped spring-mass systems with different spring stiffness but same mass, this experiment can clearly demonstrate the relationship between the natural frequency and stiffness, the occurrence of resonance and its dependence on the input frequency.
Derived from text
Mechanical Engineering; Dynamic Response; Dynamical Systems; Resonant Vibration

20030062871 Columbia Univ., New York, NY, USA
Materials for New Designs, and Designing New Materials
Fine, Leonard W.; Miller, Sam; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 477-482; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

For those of us who will have spent most of our professional lives in the second half of the 20th century, we cannot fail to see that entire century as a world of transformations. Everything changed! And the rate of change accelerated through the century. For scientists and technologists, if there ever were classical textbook models for creating, designing, and building principles and practices for engineering the future, they have been transformed by the accelerating rate of change that is the benchmark of our times. And nowhere is that better illustrated than in the changing world of engineering plastics. This brief lesson from history suggests how some ideas and some things, and some ideas about things, have come together at the interface between research and education, and between teaching and learning.
Author
Research And Development; Plastics; Mechanical Engineering; Materials Science

20030062872 Texas A&M Univ., College Station, TX, USA
Beams in Bending: An Instrumented Classroom Demonstrator
Griffin, Richard B.; Klosky, Led; VanderSchaaf, Reid; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 483-490; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

In mechanics and/or material classes, students often struggle with the concept that both material properties and geometry may affect a materials response. A four-cantilever beam setup has been designed and developed to illustrate the effect that geometry and modulus of elasticity have on the strain measured in a beam. There are three aluminum beams and one steel beam contained in the fixture. The four beams are 1 in. x 1/8 in. (steel), 1 in. x 1/8 in. (Al), 1 in. x 1/4 in (Al), and 1/4 in. x 1 in. (Al) and about 16 inches long. Weights are hung from the end of the beam, and strain gauges are located 1 1/2 in. from the fixed end of the cantilever. The strain is measured as each load is placed on the cantilever beam. A comparison may be made between steel and aluminum at 1/8 in. in thickness, and the effect of material property is demonstrated. Then, the 1/8 in. aluminum can be compared to the 1/4 in. thick aluminum beam, and now the effect of geometry can be observed. Finally, the fourth beam is turned on edge so that the 1-in. height is vertical, and a very dramatic effect on strain is observed. The unit can be brought to class and used for either in class demonstrations or can be made available for students to experiment with during, after, or before class.
Author
Mechanical Properties; Cantilever Beams; Loads (Forces); Bending

20030062878 Purdue Univ., West Lafayette, IN, USA
Recycling Waste Paper
Widener, Edward L.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 375-382; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

In view of popular 'AlGoreRhythms' for Ecology and Conservation, a basic Materials and Process Lab will include 'Pulp and Papermaking'. This involves botany, cellulose chemistry, engineering mechanics, noise and vibration, erosion and corrosion, lubrication and quality control. Employment opportunities for engineers and technologists are obvious. termites, wasps, camels, and cows. Compare the strong covalent bonds between cellulose men and the weak hydrogen bonds between paper fibers. Describe the huge (80\%) capital investment in pulp making: trees, rivers, debarkers, chippers, cookers, bleaches, washers, web-formers, dryers, and balers. Describe the complex operations of paper making and product converting: beating, blending, cleaning, refking, dyeing, sheet forming, pressing, drymg, trimming, slitting, and winding. Move over to secondary operations of embossing, printing, plying, slitting, sawing, packaging, sterilizing, warehousing, order filling, and shipping. Then note that paper making and converting have only added some 20\% to our pulp investment. So, we conclude recycled paper could cost 80\% less. This compares favorably with 95\% savings reported for recycled aluminum. Simple demonstrations of easily recycled waste papers come next. Sort scrap papers by type (consumer products, office grades, newsprint, cardboard, and magazine). Tear a four-gram sample into postage stamp pieces, drop into a quart jar of tap water, then soak and shake. Generally, more vigorous agitation is required by choppers, mixers, or blenders. Look for colors, fish-eyes, and shreds. Form a handsheet by pouring slurry through a Wire strainer and dewatering with a flat dish. Pour more slurry to make a thicker handsheet. Dry such sheets in sunshine or on a hot plate, then inspect for 'conraries'. Use reflected light for thick sheets, transmitted light for thin ones. Test your sheets for tensile pull and tear strength.
Author
Recycling; Paper (Material); Mechanical Engineering; Materials Tests; Boards (Paper)

20030062879 NASA Ames Research Center, Moffett Field, CA, USA

The Cam Shell: An Innovative Design With Materials and Manufacturing

Chung, W. Richard; Larsen, Frank M.; Kornienko, Rob; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 177-188; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Most of the personal audio and video recording devices currently sold on the open market all require hands to operate. Little consideration was given to designing a hands-free unit. Such a system once designed and made available to the public could greatly benefit mobile police officers, bicyclists, adventurers, street and dirt motorcyclists, horseback riders and many others. With a few design changes water sports and skiing activities could be another large area of application. The cam shell is an innovative design in which an audio and video recording device (such as palm camcorder) is housed in a body-mounted protection system. This system is based on the concept of viewing and recording at the same time. A view cam is attached to a helmet wired to a recording unit encased in a transparent body-mounted protection system. The helmet can also be controlled by remote. The operator will have full control in recording everything. However, the recording unit will be operated completely hands-free. This project will address the design considerations and their effects on material selection and manufacturing. It will enhance the understanding of the structure of materials, and how the structure affects the behavior of the material, and the role that processing play in linking the relationship between structure and properties. A systematic approach to design feasibility study, cost analysis and problem solving will also be discussed.

Author

Manufacturing; Concurrent Engineering; Rapid Prototyping; Video Tape Recorders; Materials Science

20030062885 Beloit Coll., WI, USA

ABCs of Nanotechnology: Atoms, Bits, and Civilization

Lisensky, George; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 285-287; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Nanotechnology has provided tools for imaging individual atoms and positioning them to create desired architectures. Developments resulting from nanotechnology have the potential to change our society on a scale similar to that of the transistor-based computer. How can the tools that scientists use to see atoms and to arrange them to create new materials be simulated in ways that make nanotechnology accessible to students? This talk uses hands-on demonstrations to illustrate some ways that high-tech materials, advanced devices, and cutting edge research can be brought into introductory classrooms and laboratories. For examples of such demonstrations from the Materials Research Science and Engineering Center on Nanostructured Materials and Interfaces at the University of Wisconsin-Madison, see http://mrsec.wisc.edu/nano

Author

Nanotechnology; Imaging Techniques; Fabrication; Simulation

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20030062789 NASA Glenn Research Center, Cleveland, OH, USA

Threshold Assessment of Gear Diagnostic Tools on Flight and Test Rig Data

Dempsey, Paula J.; Mosher, Marianne; Huff, Edward M.; June 2003; 24 pp.; In English; 59th Annual Forum and Technology Display, 6-8 May 2003, Phoenix, AZ, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-704-30-06

Report No.(s): NASA/TM-2003-212220; E-13812; NAS 1.15:212220; No Copyright; Avail: CASI; A03, Hardcopy

A method for defining thresholds for vibration-based algorithms that provides the minimum number of false alarms while maintaining sensitivity to gear damage was developed. This analysis focused on two vibration based gear damage detection algorithms, FM4 and MSA. This method was developed using vibration data collected during surface fatigue tests performed in a spur gearbox rig. The thresholds were defined based on damage progression during tests with damage. The thresholds false alarm rates were then evaluated on spur gear tests without damage. Next, the same thresholds were applied to flight data from

an OH-58 helicopter transmission. Results showed that thresholds defined in test rigs can be used to define thresholds in flight to correctly classify the transmission operation as normal.
Author
Gears; Diagnosis; Detection; Damage; Flight Tests; Vibration Tests; Fatigue Tests

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20030062120 NASA Marshall Space Flight Center, Huntsville, AL, USA
Structural Health Monitoring of Composite Wound Pressure Vessels
Grant, Joseph; Kaul, Raj; Taylor, Scott; Jackson, Kurt; Myers, George; Sharma, A.; [2002]; 2 pp.; In English; SPIE's International Symposium on Smart Materials, Nano-, and Micro-Smart Systems, 16-18 Dec. 2002, Melbourne, Australia; Copyright; Avail: CASI; A01, Hardcopy

The increasing use of advanced composite materials in the wide range of applications including Space Structures is a great impetus to the development of smart materials. Incorporating these FBG sensors for monitoring the integrity of structures during their life cycle will provide valuable information about viability of the usage of such material. The use of these sensors by surface bonding or embedding in this composite will measure internal strain and temperature, and hence the integrity of the assembled engineering structures. This paper focuses on such a structure, called a composite wound pressure vessel. This vessel was fabricated from the composite material: TRH50 (a Mitsubishi carbon fiber with a 710-ksi tensile strength and a 37 Msi modulus) impregnated with an epoxy resin from NEWPORT composites (WDE-3D-1). This epoxy resin in water dispersed system without any solvents and it cures in the 240-310 degrees F range. This is a toughened resin system specifically designed for pressure applications. These materials are a natural fit for fiber sensors since the polyimide outer buffer coating of fiber can be integrated into the polymer matrix of the composite material with negligible residual stress. The tank was wound with two helical patterns and 4 hoop wraps. The order of winding is: two hoops, two helical and two hoops. The wall thickness of the composite should be about 80 mil or less. The tank should burst near 3,000 psi or less. We can measure the actual wall thickness by ultrasonic or we can burst the tank and measure the pieces. Figure 1 shows a cylinder fabricated out of carbon-epoxy composite material. The strain in different directions is measured with a surface bonded fiber Bragg gratings and with embedded fiber Bragg gratings as the cylinder is pressurized to burst pressures. Figure 2 shows the strain as a function of pressure of carbon-epoxy cylinder as it is pressurized with water. Strain is measured in different directions by multiple gratings oriented in both axial and hoops directions.
Author
Composite Materials; Pressure Vessels; Mechanical Properties; Fabrication; Systems Health Monitoring; Structural Engineering

20030062161 NASA Langley Research Center, Hampton, VA, USA, Army Research Lab., Hampton, VA, USA
Deployment Simulation Methods for Ultra-Lightweight Inflatable Structures
Wang, John T.; Johnson, Arthur R.; June 2003; 25 pp.; In English
Contract(s)/Grant(s): 755-06-00-13
Report No.(s): NASA/TM-2003-212410; L-18294; NAS 1.15:212410; ARL-TR-2973; No Copyright; Avail: CASI; A03, Hardcopy

Two dynamic inflation simulation methods are employed for modeling the deployment of folded thin-membrane tubes. The simulations are necessary because ground tests include gravity effects and may poorly represent deployment in space. The two simulation methods are referred to as the Control Volume (CV) method and the Arbitrary Lagrangian Eulerian (ALE) method. They are available in the LS-DYNA nonlinear dynamic finite element code. Both methods are suitable for modeling the interactions between the inflation gas and the thin-membrane tube structures. The CV method only considers the pressure induced by the inflation gas in the simulation, while the ALE method models the actual flow of the inflation gas. Thus, the transient fluid properties at any location within the tube can be predicted by the ALE method. Deployment simulations of three packaged tube models; namely coiled, Z-folded, and telescopically-folded configurations, are performed. Results predicted by

both methods for the telescopically-folded configuration are correlated and computational efficiency issues are discussed.
Author
Inflatable Structures; Deployment; Membrane Structures; Gas Flow; Ground Tests

20030062248 NASA Langley Research Center, Hampton, VA, USA
Towards a Probabilistic Preliminary Design Criterion for Buckling Critical Composite Shells
Arbocz, Johann; Hilburger, Mark W.; [2003]; 9 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 7-10 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1842; No Copyright; Avail: CASI; A02, Hardcopy

A probability-based analysis method for predicting buckling loads of compression-loaded laminated-composite shells is presented, and its potential as a basis for a new shell-stability design criterion is demonstrated and discussed. In particular, a database containing information about specimen geometry, material properties, and measured initial geometric imperfections for a selected group of laminated-composite cylindrical shells is used to calculate new buckling-load 'knockdown factors'. These knockdown factors are shown to be substantially improved, and hence much less conservative than the corresponding deterministic knockdown factors that are presently used by industry. The probability integral associated with the analysis is evaluated by using two methods; that is, by using the exact Monte Carlo method and by using an approximate First-Order Second- Moment method. A comparison of the results from these two methods indicates that the First-Order Second-Moment method yields results that are conservative for the shells considered. Furthermore, the results show that the improved, reliability-based knockdown factor presented always yields a safe estimate of the buckling load for the shells examined.
Author
Predictions; Buckling; Probability Theory; Monte Carlo Method; Method Of Moments; Shell Stability; Composite Structures

20030062779 Clarkson Univ., Potsdam, NY, USA
Quantification of Energy Release in Composite Structures
Minnetyan, Levon; June 2003; 110 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG3-2393; WBS 22-708-48-11
Report No.(s): NASA/CR-2003-212351; E-13939; NAS 1.26:212351; No Copyright; Avail: CASI; A06, Hardcopy

Energy release rate is usually suggested as a quantifier for assessing structural damage tolerance. Computational prediction of energy release rate is based on composite mechanics with micro-stress level damage assessment, finite element structural analysis and damage progression tracking modules. This report examines several issues associated with energy release rates in composite structures as follows: Chapter I demonstrates computational simulation of an adhesively bonded composite joint and validates the computed energy release rates by comparison with acoustic emission signals in the overall sense. Chapter II investigates the effect of crack plane orientation with respect to fiber direction on the energy release rates. Chapter III quantifies the effects of contiguous constraint plies on the residual stiffness of a 90 ply subjected to transverse tensile fractures. Chapter IV compares ICAN and ICAN/JAVA solutions of composites. Chapter V examines the effects of composite structural geometry and boundary conditions on damage progression characteristics.
Author
Tolerances (Mechanics); Fractures (Materials); Cracking (Fracturing); Computerized Simulation; Finite Element Method; Composite Structures; Crack Propagation; Structural Analysis; Applications Programs (Computers); Mechanical Properties

20030062843 Purdue Univ., Elkhart, IN, USA
Swing Set Design: A Project In Stress Analysis
Kundu, Nikhil K.; Leach, Sarah E.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 71-82; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Using a backyard swing set is one of the most popular activities for children. This simple piece of equipment does require serious engineering considerations. Mechanical Engineering Technology at Purdue University requires among others a series of foundation courses in statics, dynamics, and strength of materials. This project was designed to reinforce students knowledge in those courses and give them an opportunity for an overall learning experience involving different aspect of design, engineering, manufacturing, and assembly operations.
Derived from text
Mechanical Engineering; Stress Analysis; Mechanical Properties; Loads (Forces)

20030062846 Purdue Univ., South Bend, IN, USA

Casting Thermoset Polymers: Process Considerations and Evaluating the Effects of Fillers on Flexural Strength

Leach, Sarah E.; Olesak, Patricia J.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 123-131; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This conference paper is a description of an experiment used by faculty to teach students the effects of fillers on flexural strength of cast thermoset polymers. Included in the paper is the prerequisite knowledge necessary for the students to understand the experiment, the necessary equipment and materials, the overall procedure, as well as the objectives which are for the students to gain hands-on experience creating and using single and multiple-use molds to cast thermoset polymer materials. Students create test bars of filled and unfilled materials which are tested as cantilever beams to determine the modulus of elasticity of the material.

CASI

Fillers; Flexural Strength; Polymerization; Thermoplasticity; Thermosetting Resins; Casting

20030062847 Youngstown State Univ., OH, USA

Viscoelastic Behavior of Foamed Polystyrene/Paper Composites

McCoy, Robert A.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 189-198; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A sandwich composite consists of a very lightweight core (such as a foamed polymer or honeycomb structure) with sheets of another material (such as paper, plastic, fiberglass, or aluminum) on the top and bottom surfaces. Applications for sandwich composites requiring both high-stiffness and lightweight include aircraft panels, boat hulls, jet skis, snow skis, partitions, and garage doors. In this experiment, the students clearly see the increase in stiffness when the top and bottom skins are added to the Styrofoam beam to form the sandwich composite. Also this experiment includes a creep test on the Styrofoam beam to illustrate the viscoelastic behavior of the polymer.

Derived from text

Polystyrene; Viscoelasticity; Sandwich Structures; Foams; Paper (Material); Creep Tests

20030062853 National Inst. of Standards and Technology, Boulder, CO, USA

The Amazing Properties of Materials

Vigliotti, Daniel P.; Alcorn, James B.; Neumeyer, Nicole A.; Cyr, D. R.; Rodriguez, A. C.; Farrell, C. N.; Leininger, L. A.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 361-374; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Materials may react in different ways to a given physical stimulus. The experiments described in this paper demonstrate several properties of materials. The experiments will include the use of materials such as Silly Putty, annealed copper tubing, and shape-memory wire. A drop test will demonstrate how methods of manufacturing can increase the strength of certain products. A stress-opticon will be used to demonstrate the techniques of stress analysis and the effects of stress concentration. Other areas explored include strength and hardness, rate dependence, metal memory, and elastic and permanent deformation. Students will be able to participate in demonstrations of some mechanical principles and determine the behavior of structural elements using visual and audible means.

Derived from text

Materials Tests; Mechanical Properties; Stress Analysis; Amorphous Materials; Crystals

20030062860 National Inst. of Standards and Technology, Gaithersburg, MD, USA

Using Micromechanics to Probe Damage Initiation in Composites

Holmes, Gale A.; McDonough, W. G.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 425-436; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Predicting the failure behavior of composite structures is an area of research that is growing in importance with the increased use of composites in structural applications. As a result, the development of computational models that predict damage accumulation in these anisotropic structures prior to failure has become a critical goal of this research area. To date, only phenomenological anisotropic damage models have been developed. However, the success of these models in

reproducing experimentally observed composite failure behavior and recent theoretical advances by Phoenix on the chain-of-bundles modeling approach suggest that the development of a predictive damage accumulation model that uses input data from experimental data may be feasible. This presentation will discuss the experimental methodologies that must be developed to provide input for such a model. In addition, experimental observations of factors that control the nucleation of critical flaws in unidirectional composites will be presented. Also, data showing how localized failure behavior changes with local changes in fiber volume fraction will be discussed.
Author
Composite Materials; Micromechanics; Mechanical Properties; Mathematical Models; Fiber Composites; Failure Analysis; Fracture Mechanics

20030062861 California Polytechnic State Univ., San Luis Obispo, CA, USA
NiTi: Magic or Phase Transformations?
Chen, Katherine C.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 61-70; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

NiTi alloys possess exciting properties and are staples of materials demonstrations. The shape memory effect and superelasticity property of NiTi fascinate people, but actually require significant materials knowledge to fully understand the phenomena. A laboratory dealing with phase transformations was thus developed to capitalize on the allure of NiTi for a juniorhenior level Thermodynamics and Kinetics of Materials course. Students examine and characterize the shape memory and superelastic properties of NiTi wire, and then realize the difference is in the transformation temperature (Le., A(sub f) - the austenitic finish temperature). They then use the phase diagram and TTT diagram to develop appropriate annealing treatments to change a sample from superelastic into shape memory behavior. Concepts of precipitation, nucleation and growth, and kinetics are incorporated into the lab. The lab is somewhat open-ended and asks the students to formulate explanations for the observed trends.
Derived from text
Phase Transformations; Titanium Alloys; Nucleation; Nickel Alloys; Thermodynamics

20030062866 California Univ., Davis, CA, USA
Heat Treatment Of Cu-Be Components For High-Frequency Coaxial Connector Assemblies: A University/Industry Design Project Collaboration
Shackelford, James F.; Powers, Michael T.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 133-142; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Accreditation criteria and employer expectations increasingly require that students obtain real world design experience before graduation. To enhance this experience for Materials Science and Engineering majors at the University of California, Davis, the Department of Chemical Engineering and Materials Science revised its senior design course. In the Spring of 2002, a new course EMS 188 (Materials Design Project) was taught jointly by the two authors. The format of the course was one in which the students worked together as a team to define, justify and develop a cost effective process for heat treating Cu-Be components used in high frequency coaxial connector assemblies (a project of ongoing interest to Agilent Technologies). To define and develop this process, the students needed to consider the desired material properties, as dictated by the component design, and how the heat treat process affects the properties. They also needed to consider pre- and post-heat treat process sequences, such as machining operations and electroplating, to ascertain what ancillary process steps may be impacted (e.g. cleaning processes). The team was expected to address economic, regulatory and environmental/safety issues associated with the proposed process design and its development. The team was responsible for designing and conducting any experiments necessary to evaluate the process design and the resulting material properties of the components. The team reviewed both batch furnace and belt furnace methods. Experimental tests on both processes were conducted to investigate resolutions to existing issues. Tests were performed to investigate a shorter residence time at a higher temperature. Experiments were run in an attempt to increase the throughput of the process. Final team recommendations focused on the belt furnace process and modifications to increase product throughput.
Derived from text
Heat Treatment; High Frequencies; Copper Alloys; Beryllium Alloys; Connectors; Experiment Design

20030062867 Akron Univ., Akron, OH, USA

Molecular Dynamics Simulations of the Mechanical Behavior of Two-Phase Polymers

Binienda, Wieslaw K.; Brostow, Witold; Hinze, J. Adam; Kinzel, Lucas; Simoes, Ricardo; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 143-152; In English; See also 20030062842; Original contains black and white illustrations

Contract(s)/Grant(s): B-1203; No Copyright; Avail: CASI; A02, Hardcopy

In order to predict the mechanical behavior of polymers such as polymer liquid crystals (PLCs) we create one and two-phase materials on a computer and subject them to tensile or compressive stress. These materials are composed of flexible and rigid segments, the later spatially arranged in the form of islands amidst the flexible matrix. A method to create realistic computer generated materials has been developed, as well as procedures to visualize in three-dimensions the materials and the simulations performed on them. We conduct molecular dynamics simulations on these materials to obtain information on crack formation and propagation as well as scratch resistance and recovery as a function of time. The results so obtained can be used to develop new real materials with improved performance and better scratch resistance. The methods used for graphical visualization can be used as a tool both in teaching and in research.

Author

Mechanical Properties; Molecular Dynamics; Computerized Simulation; Polymers; Fracture Mechanics

20030062868 Purdue Univ. Calumet, Hammond, IN, USA

Fatigue Testing Methods

Kin, Yulian; Parsons, Bernard; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 167-176; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The fatigue testing methods were incorporated into laboratory sections of the Mechanical Engineering Design Course at Purdue University Calumet. These experiments and fracture mechanics tests (observation and analysis of crack growth, determination of stress intensity factor and J-integral, accelerated fatigue testing) give our students a comprehensive knowledge of various fatigue testing techniques and the interpretation of their results. Through experimentation, students receive the necessary background in fatigue testing and statistical treatment of test results, to permit evaluation of accumulated damage and prevention of fatigue failures. The students work in teams of three or four and conduct tests at assigned load levels. These teams then share their test results, and in order to perform a reliable statistical treatment, results from previous years are included in the analysis. All accumulated data and procedures are available on our web page as well as on Blackboard(sup copyright) our e-Education provider. Formal reports are required. The reports include an introduction, all collected data from these tests as well as other sources, which are used in statistical analyses, presentation of data in the form of plots (constructed on probability graph paper), discussion of results, and conclusions. Use of appropriate software for the generation of plots is encouraged.

Derived from text

Fatigue Tests; Fracture Mechanics; Mechanical Properties; Stress Analysis

20030062888 Swinburne Univ. of Technology, Hawthorn, Australia

Apparent Effects of Geometry on Fatigue and Strength Behavior of Aluminum and Steel

Blicblau, Aaron S.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 153-165; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This conference paper describes an experiment that is designed to teach students that the strength and fatigue behaviour of metallic components is influenced by their geometry and to determine the differences in fatigue behavior of components with geometric discontinuities. The prerequisite knowledge necessary to understand the experiment, the equipment and materials used, the procedure and an overall introduction is presented. The following remarks comprise the author's closing comments: The overall fatigue results should show a decrease in the number of cycles to failure as the applied load (deformation) is increased. Since only four deflections are used, a curve of best fit is drawn through the data. The curve indeed does show that there is a decrease in fatigue life as the applied stress increases. This situation occurs for both the 90 mm radius samples and the semi-angle 36 degree notch samples. When the effect of severity of notch is compared, the semi-angle 36 degree notch samples have a marked decrease in fatigue life when compared with the 90 mm radius samples. The failed steel tensile samples are shown. All samples appeared to fail in a ductile manner. When comparing results from the tensile test, it is again seen that the semi-angle 36 degree notch samples fail at a higher stress than the other samples. The local stress at the root of the notch is higher than the 'far field' stress for either the 90 mm radius samples or the standard parallel-sided samples.

A similar result occurred for the aluminum tensile samples. This phenomenological approach is implemented for the conduct of these experiments for freshman students of engineering. Over half the cohort is comprised of electrical engineering/ computer science students and only require a basic knowledge of fatigue behavior.
CASI
Aluminum; Steels; Mechanical Properties; Fatigue (Materials); Specimen Geometry

20030063027 NASA Marshall Space Flight Center, Huntsville, AL, USA
Self-Reacting Friction Stir Welding for Aluminum Complex Curvature Applications
Brown, Randy J.; Martin, W.; Schneider, J.; Hartley, P. J.; Russell, Carolyn; Lawless, Kirby; Jones, Chip; [2003]; 31 pp.; In English; AeroMat 2003, 16-18 Jun. 2003, Dayton, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation provides an overview of sucessful research conducted by Lockheed Martin and NASA to develop an advanced self-reacting friction stir technology for complex curvature aluminum alloys. The research included weld process development for 0.320 inch Al 2219, sucessful transfer from the 'lab' scale to the production scale tool and weld quality exceeding strenght goals. This process will enable development and implementation of large scale complex geometry hardware fabrication. Topics covered include: weld process development, weld process transfer, and intermediate hardware fabrication.
CASI
Friction Stir Welding; Welded Joints; Fabrication; Weld Strength; Aluminum Alloys; Mechanical Properties

20030063125 NASA Langley Research Center, Hampton, VA, USA, Army Research Lab., Hampton, VA, USA
Method of Fabricating NASA-Standard Macro-Fiber Composite Piezoelectric Actuators
High, James W.; Wilkie, W. Keats; June 2003; 30 pp.; In English
Contract(s)/Grant(s): 755-06-00-11
Report No.(s): NASA/TM-2003-212427; L-18237; NAS 1.15:212427; ARL-TR-2833; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Macro-Fiber Composite actuator is a flexible piezoelectric composite device designed for controlling vibrations and shape deformations in high performance aerospace structures. A complete method for fabricating the standard NASA Macro-Fiber Composite actuator is presented in this document. When followed precisely, these procedures will yield devices with electromechanical properties identical to the standard actuator manufactured by NASA Langley Research Center.
Author
Piezoelectric Actuators; Fabrication; Electromechanics; Aircraft Structures; Fiber Composites

20030063167 NASA Langley Research Center, Hampton, VA, USA
Laser-Induced Fluorescence Photogrammetry for Dynamic Characterization of Transparent and Aluminized Membrane Structures
Dorrington, Adrian A.; Jones, Thomas W.; Danehy, Paul M.; Pappa, Richard S.; [2003]; 10 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA
Report No.(s): AIAA Paper 2003-4798; No Copyright; Avail: CASI; A02, Hardcopy

Photogrammetry has proven to be a valuable tool for static and dynamic profiling of membrane based inflatable and ultra-lightweight space structures. However, the traditional photogrammetric targeting techniques used for solid structures, such as attached retro-reflective targets and white-light dot projection, have some disadvantages and are not ideally suited for measuring highly transparent or reflective membrane structures. In this paper, we describe a new laser-induced fluorescence based target generation technique that is more suitable for these types of structures. We also present several examples of non-contact non-invasive photogrammetric measurements of laser-dye doped polymers, including the dynamic measurement and modal analysis of a 1m-by-1m aluminized solar sail style membrane.
Author
Laser Induced Fluorescence; Membrane Structures; Photogrammetry; Large Space Structures

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20030062754 NASA Marshall Space Flight Center, Huntsville, AL, USA
Crystal Growth of HgZnTe Alloy by Directional Solidification in Low Gravity Environment
Su, Ching-Hua; Sha, Yi-Gao; Lehoczky, S. L.; Szofran, F. R.; Gillies, D. C.; Scripa, R. N.; Cobb, S. D.; Wang, J. C.; Journal of Crystal Growth; [2002]; ISSN 0022-0248; Volume 234, pp. 487-497; In English; Copyright; Avail: Other Sources

An Hg(0.84)Zn(0.16)Te alloy crystal was back-melted and partially re-solidified during the first USA Microgravity Laboratory mission in the Marshall Space Flight Center's Crystal Growth Furnace. The experiment was inadvertently terminated at about 30\% of planned completion. Nonetheless, it was successfully demonstrated that a HgZnTe alloy ingot partially grown and quenched on the ground can be back-melted and re-grown in space under nearly steady-state growth conditions. An identical 'ground-truth' experiment was performed following the mission and a comparison between the properties of the crystals is described. The results indicate the importance of residual microgravity acceleration (less than or approx. equal to 0.4 micro-grams) even in the sub-microgravity range for the slow solidification velocities and large density gradients.
Author
Directional Solidification (Crystals); Microgravity; Crystal Growth; Mercury Tellurides; Zinc Compounds

20030062935 Delaware Univ., Newark, DE, USA
Upper Eocene Spherules at ODP Site 1090B
Liu, S.; Kyte, F. T.; Glass, B. P.; Gersonde, R.; Meteoritics and Planetary Science; 2000; Volume 35, pp. A98 - A99; In English Contract(s)/Grant(s): NAG5-9441; Copyright; Avail: CASI; A01, Hardcopy

Our two labs independently discovered upper Eocene microtektites and microkrystites at ODP Site 1090, a new South Atlantic locality near the Agulhus Ridge. This is a significant new data point for the strewn fields of these spherules, which were recently extended into the Atlantic sector of the Southern Ocean when they were reported at ODP Site 689 on the Maude Rise. The microtektites have been regarded as related to North American tektites and the microkrystites as belonging to the clinopyroxene-bearing (cpx) spherule strewn field. Initial reports indicate that Site 1090 contains a complete sequence of upper Eocene sediments composed of diatom and nannofossil oozes. The magneto- and bio-stratigraphy indicate that impact-age sediments should occur in core 30X of Hole 1090B. One of us (FTK) took 2 cc samples at 10 cm intervals over 600 cm of core for Ir analyses and the senior author (SL) took 3 cc samples at 20 cm intervals to search for spherules. Both studies proved successful and additional samples were obtained to confirm initial results and better define the Ir anomaly and spherule abundances. Peak Ir concentrations of 0.97 ng/g were found at 1090B-30X-5, 105-106cm and 0.78 ng/g at 115-116 cm. Anomalous Ir concentrations (greater than 0.1 ng/g) extend over about 100 cm of core. Preliminary results indicate that the excess Ir at this site is about 25 ng per sq cm. About 380 microtektites (>63 pm) and 2492 microkrystites (>63 pm) were recovered over a 1.8 m interval with a peak abundance of microtektites (106/gram) and microkrystites (562/gram) at 1090B-30X- 5, 114-115 cm. The largest microtektite is approximately 960 x 1140 micron in size. About 55 % are spherical, and the rest are disc, cylinder, dumbbell, teardrop, or fragments. Most of the microtektites are transparent colorless, but a few are transparent pale brown or green. Preliminary data indicate that the microtektites at Site 1090 have similar major oxide compositions to those at Site 689. About 50\% of the cpx spherules are spherical, the rest are fragments. They range from yellowish translucent to dark opaque. Based on stratigraphic data, occurrence of a positive Ir anomaly, and similar appearance and major oxide compositions of the Site 1090 spherules to those at Site 689, we believe that the spherule layer(s) are the same at both sites. However, there are significant differences between these two sites. At Site 689 the peak abundance of the cpx spherules is slightly below that of the microtektites. We can distinguish no such separation at Site 1090, despite a somewhat higher sediment accumulation rates. Peak Ir concentrations are about four times higher at Site 1090, resulting in a similarly higher total flux of Ir for this site compared to Site 689 on the Maude Rise. This is generally consistent with the flux of cpx spherules (greater than 63 pm) which is estimated to be approximately -2100 per sq cm, about twice that of Site 689D (1040 sq cm) and with the cpx-spherule component being a principal carrier of the Ir signal. The number of microtektites per sq cm (greater than 63 micron) is nearly the same at both sites, approximately 300 in 1090B and 280 in 689B. A decrease in the greater than 63 micron size fraction (consisting primarily of diatoms and radiolaria) is coincident with the spherule layer at both sites suggesting that the impact(s) that produced the spherule layer(s) may have had an adverse affect on the marine plankton.
Author
Fossils; Magnetostratigraphy; Spherules; Tektites; Micrometeorites; Meteoritic Composition; Meteoritic Microstructures

20030063016 California Univ., San Diego, CA, USA

Spherule Beds 3.47-3.24 Billion Years Old in the Barberton Greenstone Belt, South Africa: A Record of Large Meteorite Impacts and Their Influence on Early Crustal and Biological Evolution

Lowe, Donald R.; Byerly, Gary R.; Kyte, Frank T.; Shukolyukov, Alexander; Asaro, Frank; Krull, Alexander; Astrobiology; January 2003; Volume 3, No. 1, pp. 7-48; In English

Contract(s)/Grant(s): NCC2-721; NAG5-9842; NAG5-9411; NSF EAR-9909684; Copyright; Avail: Other Sources

Four layers, S1-S4, containing sand-sized spherical particles formed as a result of large meteorite impacts, occur in 3.47-3.24 Ga rocks of the Barberton Greenstone Belt, South Africa. Ir levels in S3 and S4 locally equal or exceed chondritic values but in other sections are at or only slightly above background. Most spherules are inferred to have formed by condensation of impact-produced rock vapor clouds, although some may represent ballistically ejected liquid droplets. Extreme Ir abundances and heterogeneity may reflect element fractionation during spherule formation, hydraulic fractionation during deposition, and/or diagenetic and metasomatic processes. Deposition of S1, S2, and S3 was widely influenced by waves and/or currents interpreted to represent impact-generated tsunamis, and S1 and S2 show multiple graded layers indicating the passage of two or more wave trains. These tsunamis may have promoted mixing within a globally stratified ocean, enriching surface waters in nutrients for biological communities. S2 and S3 mark the transition from the 300-million-year-long Onverwacht stage of predominantly basaltic and komatiitic volcanism to the late orogenic stage of greenstone belt evolution, suggesting that regional and possibly global tectonic reorganization resulted from these large impacts. These beds provide the oldest known direct record of terrestrial impacts and an opportunity to explore their influence on early life, crust, ocean, and atmosphere. The apparent presence of impact clusters at 3.26-3.24 Ga and approx. 2.65-2.5 Ga suggests either spikes in impact rates during the Archean or that the entire Archean was characterized by terrestrial impact rates above those currently estimated from the lunar cratering record.

Author

Biological Evolution; Crusts; Planetary Crusts; Meteorite Collisions; Impact; Cratering; Spherules

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EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20030062024 NASA Marshall Space Flight Center, Huntsville, AL, USA

Mapping the Ancient Maya Landscape from Space

Sever, Tom; January 2003; 1 pp.; In English; World Archeological Conference, 24-26 Jun. 2003, Washington, DC, USA; No Copyright; Avail: Other Sources; Abstract Only

This project uses new satellite and airborne imagery in combination with remote sensing, GIS, and GPS technology to understand the dynamics of how the Maya successfully interacted with their karst topographic landscape for several centuries in the northern Peten region of Guatemala. The ancient Maya attained one of the greatest population densities in human history in the tropical forest of the Peten, Guatemala, and it was in this region that the Maya civilization began, flourished, and abruptly disappeared for unknown reasons around AD 800. How the Maya were able to successfully manage water and feed this dense population is not known at this time. However, a recent NASA-funded project was the first to investigate large seasonal swamps (bajos) that make up 40 percent of the landscape. Through the use of remote sensing, ancient Maya features such as cities, roadways, canals and water reservoirs have been detected and verified through ground reconnaissance. The results of this research cast new light on the adaptation of the ancient Maya to their environment. Micro-environmental variation within the wetlands was elucidated and the different vegetational associations identified in the satellite imagery. More than 70 new archeological sites within and at the edges of the bajo were mapped and tested. Modification of the landscape by the Maya in the form of dams and reservoirs in the Holmul River and its tributaries and possible drainage canals in bajos was demonstrated. The recent acquisition of one-meter IKONOS imagery and high resolution STAR-3i radar imagery (2.5m backscatter/ 10m DEM), opens new possibilities for understanding how a civilization was able to survive for centuries upon a karst topographic landscape and their human-induced effects upon the local climate. This understanding is critical for the current population that is presently experiencing rapid population growth and destroying the landscape through non-traditional farming and grazing techniques, resulting in socioeconomic problems.

Author

Remote Sensing; Satellite Imagery; Computer Aided Mapping; Wetlands

20030062098 NASA Marshall Space Flight Center, Huntsville, AL, USA

Classifying Urban Land Covers Using Local Indices of Spatial Complexity

Arumugam, Mahesh; Emerson, Charles W.; Lam, Nina Siu-Ngan; Quattrochi, Dale A.; January 2003; 1 pp.; In English; Proceedings of the American Society for Photogrammetry and Remote Sensing, 5-7 May 2003, Anchorage, AK, USA; Copyright; Avail: Other Sources; Abstract Only

The skewed statistical distributions of land cover types in complex, heterogeneous urban areas limits the effectiveness of traditional spectrally based maximum-likelihood classifiers. This work examines the utility of fractal dimension and Moran's I index of spatial autocorrelation in segmenting high-resolution panchromatic and lower-resolution multispectral imagery. Tools available in the Image Characterization and Modeling System (ICAMS) were used to analyze multi-temporal and multi-platform imagery of Atlanta, Georgia. In this example, land cover change trajectories from forest or grassland to built up land covers lead to decreased spatial autocorrelation. In lower resolution imagery such as Landsat MSS, the complex details of forested land covers and urbanized areas are smoothed, and texture-based change detection is less effective. Although segmentation of panchromatic images is possible using fractal dimension or Moran's I, widely differing land covers often yield similar values of these indices. Better results are obtained when a surface of local fractal dimension or spatial autocorrelation is combined as an additional layer in a supervised maximum-likelihood multispectral classification.

Author

Land Use; Maximum Likelihood Estimates; Autocorrelation; Classifications; Statistical Distributions

20030062791 NASA Goddard Space Flight Center, Greenbelt, MD, USA

First Moderate Resolution Imaging Spectroradiometer (MODIS) Snow and Ice Workshop

Hall, Dorothy K., Editor; October 1995; 129 pp.; In English; First Moderate Resolution Imaging Spectroradiometer (MODIS) Snow and Ice Workshop, 13 Sep. 1995, Reston, VA, USA; See also 20030062792 - 20030062813; Original contains black and white illustrations

Report No.(s): NASA/CP-3318; Rept-96B00001; NAS 1.55:3318; No Copyright; Avail: CASI; A07, Hardcopy

This document is a compilation of summaries of talks presented at a 2-day workshop on Moderate Resolution maging Spectroradiometer (MODIS) snow and ice products. The objectives of the workshop were to: inform the snow and ce community of potential MODIS products, seek advice from the participants regarding the utility of the products, and letermine the needs for future post-launch MODIS snow and ice products. Four working groups were formed to discuss at-launch snow products, at-launch ice products, post-launch snow and ice products and utility of MODIS snow and ice products, respectively. Each working group presented recommendations at the conclusion of the workshop.

Author

Modis (Radiometry); Snow; Ice; Meteorological Satellites

20030062792 National Ice Center, Washington, DC, USA

Use of Satellite Data for Operational Sea Ice and Lake Ice Monitoring

Bertoia, Cheryl; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 29-32; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

The U.S. National Ice Center (NIC) is a tri-agency funded organization responsible for providing global sea ice and Great Lakes ice data to military, government, foreign and commercial customers. Sponsoring organizations include the Navy, the National Oceanic and Atmospheric Administration and the U . S . Coast Guard. Satellite derived data are the primary data source for NIC ice analyses and forecast products. During the past fifteen years, analysis techniques have progressed from manual procedures to the integration of multiple sources in a digital workstation environment.

Author

Sea Ice; Lake Ice; Ice Mapping; Satellite Observation

20030062793 Research and Data Systems, Inc., Greenbelt, MD, USA

MODIS Snow and Ice Algorithm Development

Riggs, George; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 55-60; In English; See also 20030062791; No Copyright; Avail: CASI; A02, Hardcopy

Context of the Moderate Resolution Imaging Spectroradiometer (MODIS) snow and ice algorithms in the Earth Observing System Data and Information System (EOSDIS) is described. Format and content of the data products generated by the algorithms are presented. Algorithm techniques and results are discussed. Requirements for and content of metadata

and quality assessment data for the products are briefly discussed. Description of current status of algorithms concludes the presentation.
Author
Modis (Radiometry); Snow; Ice; Algorithms; Eos Data And Information System

20030062794 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Measurement of the Spectral Absorption of Liquid Water in Melting Snow With an Imaging Spectrometer
Green, Robert O.; Dozier, Jeff; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 67-70; In English; See also 20030062791; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Melting of the snowpack is a critical parameter that drives aspects of the hydrology in regions of the Earth where snow accumulates seasonally. New techniques for measurement of snow melt over regional scales offer the potential to improve monitoring and modeling of snow-driven hydrological processes. In this paper we present the results of measuring the spectral absorption of liquid water in a melting snowpack with the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). AVIRIS data were acquired over Mammoth Mountain, in east central California on 21 May 1994 at 18:35 UTC. The air temperature at 2926 m on Mammoth Mountain at site A was measured at 15-minute intervals during the day preceding the AVIRIS data acquisition. At this elevation. the air temperature did not drop below freezing the night of the May 20 and had risen to 6 degrees Celsius by the time of the overflight on May 21. These temperature conditions support the presence of melting snow at the surface as the AVIRIS data were acquired.
Author
Imaging Spectrometers; Infrared Spectrometers; Absorption Spectra; Water; Snow; Melting

20030062795 National Oceanic and Atmospheric Administration, Ann Arbor, MI, USA
Satellite Mapping of Great Lakes Ice Cover
Leshkevich, George A.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 87-91; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

Much of the satellite ice interpretation algorithm development in the Great Lakes region began during the Extension to the Navigation Season Demonstration Study conducted during the 1970's. However, many of the early studies were done by visual interpretation of satellite and other remotely sensed data. Starting in the mid-1970's, a series of studies including field studies and computer digital image processing, explored techniques and algorithms to classify and map freshwater ice cover using Landsat, NOAA/AVHRR, and ERS-1 SAR data. The goal of much of this work is to develop an automated or semi-automated method to classify and map Great Lakes ice cover using satellite digital imagery.
Author
Satellite Imagery; Ice Mapping; Great Lakes (North America); Lake Ice; Image Processing

20030062796 Wisconsin Univ., Madison, WI, USA
An Introduction to the Cloud Mask for the MODIS
Ackerman, S. A.; Strabala, K. I.; Frey, R. A.; Moeller, C. C.; Menzel, W. P.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 93-97; In English; See also 20030062791; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The 36 channel MODerate resolution Imaging Spectrometer (MODIS) on the Earth Observing System (EOS) AM-1 platform is scheduled for launch in 1998. In preparation for a MODIS day-1 cloud mask product, data from the AVHRR, HIRS/2 and MODIS Airborne Simulator (MAS) are being used to develop a multispectral cloud mask algorithm. MAS flies on board NASA's high altitude ER-2 aircraft collecting 50 meter resolution data across a 37 km swath. The multispectral nature of MAS (and later MODIS) enhances cloud detection capability, especially for highly variant surface, atmospheric, and cloud characteristics present on the global scale. A three month global data set of collocated AVHRR and HIRS/2 observations is also being used to develop the algorithm. This collocated data set has the advantage of containing many IR observations that are similar to the planned MODIS channels. AVHRR LAC scenes are also being used to familiarize the algorithm with handling a large 1 km spatial resolution data set.
Author
Modis (Radiometry); Clouds (Meteorology); Masking; Multispectral Photography

20030062797 Bern Univ., Bern, Switzerland

MODIS At-launch Snow Products

Baumgartner, Michael; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 119-121; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

Basic questions, algorithm questions, and technical questions about MODIS at-launch Snow Products are listed and discussed. The basic questions are about the audience (users), optimal resolution, operational considerations, temporal aspects, raw data, metadata, and the gridding scheme. Algorithm questions cover the need for regional algorithms and resolution, potential improvements, and accuracy. The technical questions are on the development of hardware, technical limitations, and financial aspects.

CASI

Modis (Radiometry); Snow; Product Development

20030062798 National Ice Center, Washington, DC, USA

MODIS At-launch Ice Products

Bertoia, Cheryl; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 123-124; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

The questions addressed for Moderate Resolution Imaging Spectroradiometer (MODIS) at-launch ice products cover time frame, composite maps, usefulness, use of products, and metadata. The needs for both improved ice identification and a cloud mask are discussed.

Author

Modis (Radiometry); Ice Mapping; Product Development; Identifying

20030062799 South Dakota School of Mines and Technology, Rapid City, SD, USA

Post-Launch MODIS Snow and Ice Products

Welch, Ron; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 125-126; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

This summary of a discussion of Post-launch Moderate Resolution Imaging Spectroradiometer (MODIS) snow and ice products raises issues connected to imaging specific types of surfaces, time/space averaging, specific MODIS users, and the gridding and projection of data. Spectral albedo is among the characteristics needed for imaging snow, ice sheet, and sea/lake ice surfaces. Also needed are subpixel snow coverage, snow under trees, snow wetness, snow and ice temperature, open water, ice types, melt ponds, ice edge, and ice motion. Snow and ice products are needed for water resources management and for transportation, including ship routing. Outside experts are needed for gridding and projections due to a lack of knowledge.

CASI

Modis (Radiometry); Product Development; Snow Cover; Sea Ice; Lake Ice

20030062800 Atmospheric Environment Service, Ottawa, Ontario, Canada

Utility of MODIS Snow and Ice Products

Walker, Anne; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 127-128; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

Moderate Resolution Imaging Spectrometer (MODIS) snow and ice products have operational and research users. The advantages of MODIS are its resolution and its ability to discriminate between clouds and snow. Metadata needs vary with each MODIS product.

CASI

Modis (Radiometry); Snow; Ice

20030062801 Colorado Univ., Boulder, CO, USA

Mapping Fractional Snow Covered Area and Sea Ice Concentrations

Nolin, Anne W.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 39-49; In English; See also 20030062791; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This research assesses the efficacy of using spectral mixture analysis (SMA) as a tool for global mapping of snow-covered area and sea ice concentration at sub-pixel spatial resolution. The spatial distributions of snowcover and seaice is needed for climate models, where surface albedo is used as a lower boundary condition, and for snowmelt/runoff models, in which

snow-covered area is needed for spatially-distributed melt calculations. One of the fundamental difficulties in producing estimates of snow-covered area using remote sensing techniques has been distinguishing snow from other surface covers in a scene. A second major difficulty lies with the mixed pixel effect that arises from the spectral input of different materials (snow, vegetation, liquid water, etc.) in the sensor field-of-view. Binary classifications from remote sensing data categorize pixels as either completely snow-covered or completely non-snow-covered. This simplistic approach may introduce large errors in the estimation of snow covered area, particularly in regions where and at times when snow cover is patchy and discontinuous. One distinct advantage of the SMA technique is that it allows one to estimate the fractional snowcover in a pixel. In addition, the fit of the model to the data can be tested and, unlike most binary classification methods, an error estimate is provided. SMA uses a linear mixing model in which the sensor response for an image pixel is expressed as a linear combination of the fractional quantity of each component present in the pixel. Thus, each pixel spectrum holds information about both the spectral signature and the fractional abundance of a component. Figure 1 depicts the hypothetical spectrum of a pixel containing 60. In a multispectral image each pixel can be modeled as a linear combination of components identified for that image. Such image Components are termed 'endmembers' and they are thought to be representative of a finite set of spectrally-unique ingredients in the image.
Author
Snow Cover; Sea Ice; Ice Mapping; Spectral Mixture Analysis

20030062802 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Satellite Snow-Cover Mapping: A Brief Review
Hall, Dorothy K.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 15-22; In English; See also 20030062791; No Copyright; Avail: CASI; A02, Hardcopy

Satellite snow mapping has been accomplished since 1966, initially using data from the reflective part of the electromagnetic spectrum, and now also employing data from the microwave part of the spectrum. Visible and near-infrared sensors can provide excellent spatial resolution from space enabling detailed snow mapping. When digital elevation models are also used, snow mapping can provide realistic measurements of snow extent even in mountainous areas. Passive-microwave satellite data permit global snow cover to be mapped on a near-daily basis and estimates of snow depth to be made, but with relatively poor spatial resolution (approximately 25 km). Dense forest cover limits both techniques and optical remote sensing is limited further by cloudcover conditions. Satellite remote sensing of snow cover with imaging radars is still in the early stages of research, but shows promise at least for mapping wet or melting snow using C-band (5.3 GHz) synthetic aperture radar (SAR) data. Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS) data beginning with the launch of the first EOS platform in 1998. Digital maps will be produced that will provide daily, and maximum weekly global snow, sea ice and lake ice cover at 1-km spatial resolution. Statistics will be generated on the extent and persistence of snow or ice cover in each pixel for each weekly map, cloudcover permitting. It will also be possible to generate snow- and ice-cover maps using MODIS data at 250- and 500-m resolution, and to study and map snow and ice characteristics such as albedo. been under development. Passive-microwave data offer the potential for determining not only snow cover, but snow water equivalent, depth and wetness under all sky conditions. A number of algorithms have been developed to utilize passive-microwave brightness temperatures to provide information on snow cover and water equivalent. The variability of vegetative Algorithms are being developed to map global snow and ice cover using Earth Algorithms to map global snow cover using passive-microwave data have also cover and of snow grain size, globally, limits the utility of a single algorithm to map global snow cover.
Author
Snow Cover; Satellite Imagery; Mapping; Infrared Imagery; Imaging Radar; Microwave Imagery

20030062803 National Oceanic and Atmospheric Administration, Camp Springs, MD, USA
Interactive Multisensor Snow and Ice Mapping System
Ramsay, Bruce H.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 23-27; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of the snow and ice charting performed by the Synoptic Analysis Branch is to produce timely, high quality analyses depicting northern hemispheric snow and ice cover. The primary data source is visible imagery acquired from NOAA-n polar orbiting satellites and is stored in hardcopy. Secondary data sources include on-line GOES, GMS, and METEOSAT imagery, hardcopy Air Force snow analyses, and surface observations. Data needs are season dependent. Snow and ice cover identification is made by the manual inspection of hardcopy imagery and graphics products, on-line imagery loops, and the previous week's analysis. Chart quality is predicated on the availability of clear sky visible imagery and the meteorologist's experience. After all boundaries have been identified, a finalized hardcopy snow and ice chart is manually

prepared by the analyst by transferring the boundary lines to the chart. An electronic version of the finalized snow and ice chart is made for archival storage through the digitization of a gridded acetate overlay of the chart. Quality control is either self-imposed by the meteorologist performing the analysis or by the focal point meteorologist. Upon completion, which takes up to 10 hours during the snow season, the hardcopy snow and ice chart is faxed to users such as the National Meteorological Center, Climate Analysis Center, Department of Agriculture, Universities, Foreign Governments, and a number of other customers. During the NOAA-K,L,M time period, there will be several automated snowmaps of differing accuracy. These include the Advanced Very High Resolution Radiometer (AVHRR)/3 snowmap from NOAA-K, L, and M, the Advanced Microwave Sounding Unit (AMSU) snowcover map, the Special Sensor Microwave/Imager (SSM/I) snowmap, and the Air Force three-dimensional (3-D) Nephanalysis snow product. All of the products are daily except the AVHRR snowmap, which will be produced weekly. In addition, clear sky imagery from both the POES and GOES show the snowline very well. The problem is that visible and infrared techniques suffer from persistent cloudcover near the snowline. This makes observations difficult and infrequent. The microwave snow products are mostly independent of cloudcover: all may be inaccurate under certain circumstances or over specific types of terrain. With several products of varying accuracy, it is advantageous to allow an analyst to assess each snowcover map and from them to interactively produce a composite that is a more accurate snowcover map.

Author

Ice Mapping; Multisensor Fusion; Northern Hemisphere; Imagery

20030062804 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Questions/Issues to be Discussed at the Snow/Ice Workshop

Hall, Dorothy K.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 59; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

How soon after acquisition will you need the snow/ice maps? For the composite maps, which do you prefer, a composite of 7 days, 10 days, other, and why? What would be the most useful MODIS at-launch and post-launch snow and ice products? Specifically what would you use the products for? What metadata should be included with the data products? For example, quality control data are metadata. Image i.d.# and lat/long are also metadata. What improvements can you suggest to the snow and ice products as currently planned?

Author

Snow; Ice Mapping; Product Development; Satellite Imagery; Maps

20030062805 Rutgers Univ., New Brunswick, NJ, USA

An Analysis of the NOAA Satellite-Derived Snow-Cover Record, 1972 - Present

Robinson, David A.; Frei, Allan; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 61-65; In English; See also 20030062791; Original contains black and white illustrations

Contract(s)/Grant(s): NSF ATM-93-14721; NSF SBR-93-20786; NAGW-3568; No Copyright; Avail: CASI; A01, Hardcopy

The large-scale distribution of snow cover over northern hemisphere lands has been a topic of increasing attention in recent years. This interest has been spurred, at least in part, by concerns associated with potential changes in the global climate system associated with anthropogenic and natural causes. Satellite observations using visible satellite imagery permit a hemispheric analysis of snow extent. For almost three decades the National Oceanic and Atmospheric Administration (NOAA) has been using visible imagery to produce weekly charts depicting the extent of snow cover over northern hemisphere lands. These charts constitute the longest satellite-derived environmental dataset available on a continuous basis and produced in a consistent manner. We will briefly describe the NOAA charts and then provide an update on the variability of snow extent over the hemisphere from January 1972 through August 1995. Concentration will be on snow kinematics.

Author

Satellite Imagery; Snow Cover; Noaa Satellites

20030062806 Colorado Univ., Boulder, CO, USA

Potential MODIS Applications for Ice Surface Studies based on AVHRR Experience

Steffen, Konrad; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 79-80; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

The tie point algorithm for ice concentration assumes the presence of 100\% white ice and ice free surfaces at specific locations known as tie points. The ice concentration corresponding to any pixel on an image can then be calculated. The

threshold algorithm can classify four ice types with different thicknesses according to surface reflectance. To derive surface albedo values from satellite narrow-band radiance measurements, the scattering and absorption of the atmosphere has to be included. Radiance variations caused by small off-nadir angles are significant for large field of view scanners.
CASI
Modis (Radiometry); Advanced Very High Resolution Radiometer; Algorithms; Sea Ice

20030062807 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cloud Masking and Surface Temperature Distribution in the Polar Regions Using AVHRR and other Satellite Data
Comiso, Joey C.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 81-85; In English; See also 20030062791; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Surface temperature is one of the key variables associated with weather and climate. Accurate measurements of surface air temperatures are routinely made in meteorological stations around the world. Also, satellite data have been used to produce synoptic global temperature distributions. However, not much attention has been paid on temperature distributions in the polar regions. In the polar regions, the number of stations is very sparse. Because of adverse weather conditions and general inaccessibility, surface field measurements are also limited. Furthermore, accurate retrievals from satellite data in the region have been difficult to make because of persistent cloudiness and ambiguities in the discrimination of clouds from snow or ice. Surface temperature observations are required in the polar regions for air-sea-ice interaction studies, especially in the calculation of heat, salinity, and humidity fluxes. They are also useful in identifying areas of melt or meltponding within the sea ice pack and the ice sheets and in the calculation of emissivities of these surfaces. Moreover, the polar regions are unique in that they are the sites of temperature extremes, the location of which is difficult to identify without a global monitoring system. Furthermore, the regions may provide an early signal to a potential climate change because such signal is expected to be amplified in the region due to feedback effects. In cloud free areas, the thermal channels from infrared systems provide surface temperatures at relatively good accuracies. Previous capabilities include the use of the Temperature Humidity Infrared Radiometer (THIR) onboard the Nimbus-7 satellite which was launched in 1978. Current capabilities include the use of the Advance Very High Resolution Radiometer (AVHRR) aboard NOAA satellites. Together, these two systems cover a span of 16 years of thermal infrared data. Techniques for retrieving surface temperatures with these sensors in the polar regions have been developed. Errors have been estimated to range from 1K to 5K mainly due to cloud masking problems. With many additional channels available, it is expected that the EOS-Moderate Resolution Imaging Spectroradiometer (MODIS) will provide an improved characterization of clouds and a good discrimination of clouds from snow or ice surfaces.
Author
Air Sea Ice Interactions; Masking; Polar Regions; Surface Temperature; Temperature Distribution; Clouds (Meteorology)

20030062808 Statkraft, Norway
SNOWSAT: Operational Snow Mapping in Norway
Andersen, Tom; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 101-102; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

Information on the amount of snow in drainage basins is very important to hydroelectric power companies in Norway, since all electricity generation in the country is based on water power and Norway has one of the world's most liberal laws for energy generation, trade and distribution. Relevant snow data is therefore classified as commercial (and non-public) data of high economic value. A substantial part of the drainage basins are located in high mountain areas where more than 50\% of the precipitation falls as snow. The amount and distribution of the snow is crucial information for planning of the power production. For several years Statkraft (the largest Norwegian hydroelectric power company) has perfonned analyses of images from the NOAA AVHRR sensors in order to determine the snow cover throughout the melting season. The results are used as input data to snow melting simulation models (e.g. the HBV model).
Author
Hydroelectricity; Norway; Snow Cover; Mapping; Image Analysis

20030062809 Eidgenoessische Technische Hochschule, Zurich, Switzerland
Multisensor Analysis of Satellite Images for Regional Snow Distribution
Seidel, Klaus; Ehrler, Cornel; Martinec, Jaroslav; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 103-110; In English; See also 20030062791; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The method is presented to evaluate areal average water equivalents of the seasonal snow cover by periodical snow cover mappings from multispectral satellite recordings. As a refinement of earlier preliminary results, an extra-polation procedure is applied using GIS techniques in order to analyze image segments obscured by clouds or by forest canopy. In the Upper Rhine basin at Felsberg (3250 sq km, 560-3614 m a.s.l.), the snow water equivalent on 1 April in four different years was evaluated for 5 elevation zones in 9 partial areas. Conventional depletion curves of snow covered areas were derived from SPOT-XS, Landsat-MSS and Landsat-TM data and converted to the so called modified depletion curves which indicate the snow water equivalent. A comparison with terrestrial measurements is limited by the insufficient snow gauging network above 2000 m a.s.l. Areal water equivalents interpolated for 2000 m a.s.l. indicate that the snow accumulation is persistently greater in the western part of the Felsberg basin than in the eastern part. In the middle part, the North-South relation of the snow accumulation changed from year to year.
Author
Satellite Imagery; Snow Cover; Multisensor Fusion; Geographic Information Systems

20030062810 Colorado Univ., Boulder, CO, USA
MODIS Activities at the National Snow and Ice Data Center DAAC
Scharfen, Greg; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 111-116; In English; MODIS Snow and Ice Workshop, 14 Sep. 1995; See also 20030062791; No Copyright; Avail: CASI; A02, Hardcopy

The National Snow and Ice Data Center (NSIDC), at the University of Colorado in Boulder, is participating in Earth Observing System Data and Information System (EOSDIS) as a Distributed Active Archive Center (DAAC) for snow and ice data products. The NSIDC DAAC is one of nine discipline and/or instrument-specific DAACs in EOSDIS. NSIDC is funded by NASA, NOAA and the National Science Foundation. The DAAC is NSIDC's largest project to date. The NSIDC DAAC will produce and/or archive level 2 and 3 EOSDIS standard products pertaining to the snow and ice community as well as relevant in-situ data. NSIDC also intends to implement non-standard products developed by relevant Interdisciplinary Science (IDS) Teams such as Polar Exchange at the Sea Surface (POLES). These may be produced from data collected by several EOS sensors including: Moderate Resolution Imaging Spectroradiometer (MODIS), GLAS, ASTER, AMSR and MISR. There are also several NOAA/NASA Pathfinder products being produced and archived at NSIDC. NSIDC has been producing, archiving and distributing sea ice extent and concentration information derived from passive microwave satellite observations since the mid-1980s. The combined Scanning Multichannel Microwave Radiometer (SMMR) and Spectral Sensor Microwave Imager (SSM/I) record now spans from 1979-94, and is available on CD-ROM. The annual cycle of sea ice extent shows some variation from year to year, and these data are being related to synoptic weather patterns by polar scientists. A combined sea ice/snow cover product from the passive microwave is under development.
Author
Snow; Ice Mapping; Eos Data And Information System; Modis (Radiometry)

20030062811 Bern Univ., Bern, Switzerland
Monitoring Swiss Alpine Snow Cover Variations Using Digital NOAA-AVHRR Data
Baumgartner, Michael F.; Holzer, Thorbjoern; Apfl, Gabriela; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 33-39; In English; See also 20030062791; No Copyright; Avail: CASI; A01, Hardcopy

Within a research project and the program for a Hydrologic Atlas of Switzerland, charts of the extent and the variations of the snow cover in Switzerland for two hydrologically and meteorologically different years were derived from digital NOAA-AVHRR data. During the two years. 32 satellite scenes were classified using supervised classification techniques. For the generation of the snow cover charts, up to 12 categories (several sub-categories for vegetation, water, snow, and clouds) were used. The final results were thematic maps differentiating between snow covered and non-snow covered (aper) areas. The snow cover charts were geocoded to the Swiss reference system using a ground-control-point approach allowing the superimposition onto a Digital Elevation Model (DEM) and a digital boundary map of Switzerland within a Geographic Information System (GIS). Based on this data set, the snow coverage and its variations as well as the snowline for the two years under investigation were determined for several river basins in Switzerland. Furthermore, snow cover depletion curves for the two ablation periods, separately for several elevation zones, were generated which were necessary for snowmelt runoff computations in the Rhine-Felsberg basin using the SRM Model.
Author
Alps Mountains (Europe); Switzerland; Snow Cover; Satellite Observation; Thematic Mapping; Digital Elevation Models

20030062812 Boston Univ., Boston, MA, USA

Estimating Cloud and Surface Parameters at High Latitudes With AVHRR Data

Key, Jeff; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 73-77; In English; See also 20030062791; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The EOS interdisciplinary project entitled Polar Exchange at the Sea Surface (POLES; D. Rothrock, PI) has as its goal the quantitative understanding of the exchanges of energy, momentum, and water in the atmosphere-ice-ocean system of the polar regions. Models of this complex system are being developed and are driven by or validated with geophysical fields estimated using satellite data. Several planned MODIS products are of interest to POLES: sea ice albedo, cloud cover, cloud top height, cloud transmissivity, sea ice edge, and sea surface temperature. Sea ice motion and sea ice concentration, though usually estimated using active and passive microwave sensors, could be generated using MODIS data and would also be useful to POLES. While we look forward to a steady stream of MODIS data in the years to come, we need these geophysical fields now. We have therefore become engaged in a significant effort to develop algorithms for the retrieval of surface and cloud parameters using AVHRR and TOVS data. With AVHRR, methods have been developed to estimate cloud amount, cloud optical depth, cloud particle effective radius, cloud top temperature, surface temperature of snow and ice, surface albedo of snow and ice, downwelling shortwave and longwave fluxes at the surface.

Author

Advanced Very High Resolution Radiometer; Polar Regions; Air Sea Ice Interactions; Algorithms; Clouds (Meteorology); Ocean Surface; Tiros N Series Satellites; Estimating

20030062813 National Weather Service, Chanhassen, MN, USA

Remote Sensing of Snow in the Cold Regions

Carroll, Thomas R.; Proceedings of the First Moderate Resolution Imaging Spectroradiometer (MODIS) Workshop on Snow and Ice; October 1995, pp. 3-14; In English; See also 20030062791; No Copyright; Avail: CASI; A03, Hardcopy

The National Weather Service (NWS) maintains the National Operational Hydrologic Remote Sensing Center, based in Minneapolis, to generate operational hydrologic products from in situ and remotely sensed snow cover data sets. The Center maintains an Airborne Snow Survey Program, a Satellite Hydrology Program, and a Snow Estimation and Updating Program. In all three programs, the Center relies heavily on the use of multiple Geographic Information Systems (GIS) to process, analyze, and distribute spatial snow cover data sets. Real-time, airborne snow water equivalent data and satellite areal extent of snow cover data are used operationally by the National Weather Service, the U.S. Army Corps of Engineers and other Federal, state, and private agencies when issuing spring flood outlooks, water supply outlooks, river and flood forecasts, and reservoir inflow forecasts. The remotely sensed and interpolated, gridded, snow water equivalent data products are generated by hydrologists in the Minneapolis office and distributed electronically, in near real-time, to NWS and non-NWS end-users in both alphanumeric and graphic format. The reliable, real-time, snow water equivalent information is critical to water managers and disaster emergency services officials who are required to make decisions with regard to snowmelt flooding, reservoir regulation, and water supply allocation.

Author

Remote Sensing; Snow; Low Temperature Environments

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20030062137 NASA Marshall Space Flight Center, Huntsville, AL, USA

Ion Dynamic Capture Experiments With The High Performance Antiproton Trap (HiPAT)

Martin, James; Lewis, Raymond; Chakrabarti, Suman; Sims, William H.; Pearson, J. Boise; Fant, Wallace E.; [2002]; 8 pp.; In English; STAIF 2003, 2-6 Feb. 2003, Albuquerque, NM, USA; Copyright; Avail: CASI; A02, Hardcopy

To take the first step towards using the energy produced from the matter-antimatter annihilation for propulsion applications, the NASA Marshall Space Flight Center (MSFC) Propulsion Research Center (PRC) has initiated a research activity examining the storage of low energy antiprotons. The High Performance Antiproton Trap (HiPAT) is an electromagnetic system (Penning-Malmberg design) consisting of a 4 Tesla superconductor, a high voltage electrode

confinement system, and an ultra high vacuum test section. It has been designed with an ultimate goal of maintaining 10(exp 12) charged particles with a half-life of 18 days. Currently, this system is being evaluated experimentally using normal matter ions that are cheap to produce, relatively easy to handle, and provide a good indication of overall trap behavior (with the exception of assessing annihilation losses). The ions are produced via a positive hydrogen ion source and transported to HiPAT in a beam line equipped with electrostatic optics. The optics serve to both focus and gate the incoming ions, providing microsecond-timed beam pulses that are dynamically captured by cycling the HiPAT forward containment field like a 'trap door'. Initial dynamic capture experiments have been successfully performed with beam energy and currents set to 1.9 kV and 23 micro-amps, respectively. At these settings up to 2x10(exp 9) ions have been trapped during a single dynamic cycle.
Author
Antiprotons; Superconductors (Materials); Charged Particles; Annihilation Reactions; Positive Ions; Beam Currents

20030062184 NASA Glenn Research Center, Cleveland, OH, USA
A Flywheel Energy Storage System Demonstration for Space Applications
Kenny, Barbara H.; Kascak, Peter E.; Jansen, Ralph; Dever, Timothy; June 2003; 12 pp.; In English; International Electric Machines and Drives Conference, 1-4 Jun. 2003, Madison, WI, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 755-12-10
Report No.(s): NASA/TM-2003-212346; E-13934; NAS 1.15:212346; Copyright; Avail: Other Sources

A novel control algorithm for the charge and discharge modes of operation of a flywheel energy storage system for space applications is presented. The motor control portion of the algorithm uses sensorless field oriented control with position and speed estimates determined from a signal injection technique at low speeds and a back EMF technique at higher speeds. The charge and discharge portion of the algorithm use command feed-forward and disturbance decoupling, respectively, to achieve fast response with low gains. Simulation and experimental results are presented.
Author
Flywheels; Energy Storage; Magnets; Motors; Electrical Properties; Dischargers; Spacecraft Power Supplies

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20030062254 Universidad Nacional Autonoma de Mexico, Mexico City, Mexico
Radiative Forcing of the Lower Stratosphere over the Arctic by Light Absorbing Particles
Baumgardner, D.; Raga, G.; Kok, G.; [2003]; 14 pp.; In English; Copyright; Avail: Other Sources

Light absorbing particles (LAP), such as soot and dust, change the thermodynamic structure of the atmosphere and contribute to regional and global climate change. The lower stratosphere (LS) is particularly sensitive to the presence of LAP since the lifetime of particles in the LS may extend from months to years, in contrast to tropospheric lifetimes of at most a few days. The source of particles in the LS may be aircraft, meteorites or emissions from tropospheric sources. There has been a lack, however, of accurate, quantitative measurements made with sufficiently sensitive instruments. This limits our understanding of the origin and lifetime of aerosols in this region of the atmosphere. Here we present recent measurements in the Arctic UT/LS with a new, highly sensitive instrument that has detected black carbon (BC) mass concentrations of 20-1000 ng m(exp -3) that are 10-1000 times larger than those reported in previous studies and are at least 30 times larger than predicted masses based on fuel consumption by commercial aircraft that fly in these regions. Scattering and absorption of solar and terrestrial radiation by the particles in a layer from 8- 12 Km leads to a negative net forcing of -0.5 W sq m at the top of the atmosphere and 9C of heating in this layer during the average aerosol lifetime at these altitudes. The new measurements suggest that the influence of aircraft emissions have been underestimated or that aircraft may not be the only significant source of light absorbing particles in the UT/LS. The presence of these aerosols can cause local changes in the thermal structure of the lower stratosphere and a subsequent modification of stratosphere/tropopause exchange of gases and particles.
Author
Stratosphere; Aerosols; Arctic Regions; Carbon; Atmospheric Attenuation; Soot; Temperature Distribution

20030063174 University of Southern California, Los Angeles, CA
Plasma Based Devices
Gundersen, M.; Dec. 2001; 31 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0408
Report No.(s): AD-A411648; ARO-38947.4-PH; No Copyright; Avail: CASI; A03, Hardcopy

Plasma processing is now considered an exciting prospect for control of noxious effluents from many different sources including diesel engines, power plants, factories, and incinerators. Energy-efficient plasma-based technologies, supported through this grant, are now under commercial investigation for pollution abatement, and have potential for reduced emissions, higher efficiencies, simplified processing, and lower costs, while allowing the use of existing power plants and energy sources. Such advances are critically important to the maintenance of a competitive industrial infrastructure while simultaneously reducing pollutants, greenhouse gases and energy-usage. --Successful plasma-systems for emissions control will, for example, allow continued use of energy-efficient diesel engines in moving and stationary sources, and can be detached under emergency DOD conditions. One attaches a plasma 'muffler' to provide a plasma chemistry that takes advantage of significantly enhanced plasma-chemical processes through increased rates and related cross-sections of interactions between species which reduces emissions. Research supported by the ARO at USC has developed new plasma technology for remediation of nitrogen oxides (NOx) sources including diesel engines. In work to date, we have found efficient, effective NOx reduction using pulsed power techniques. This method will have broad and very significant impact on the reduction of other forms of air pollution. This technology will, in our judgment, also allow plasma treatment of volumes of combustive fuel by ion and radical injection at low energy cost, thus enhancing combustion, reducing emissions and signatures, and holding promise for leaner-burning combustants, all of which are important for the DOD. The most promising methods are based on applications of transient plasmas and on advanced power conditioning.
DTIC
Electron Accelerators; Monitors; Environmental Monitoring; Emission; Plasmas (Physics)

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20030062107 Boston Univ., Boston, MA, USA
Substorm Evolution in the Near-Earth Plasma Sheet
Erickson, Gary M.; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-9110; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this project is to determine precursors and signatures of local substorm onset and how they evolve in the plasma sheet using the Geotail near-Earth database. This project is part of an ongoing investigation involving this PI, Nelson Maynard (Mission Research Corporation), and William Burke (AFRL) toward an empirical understanding of the onset and evolution of substorms. The first year began with dissemination of our CRRES findings, which included an invited presentation and major publication. The Geotail investigation began with a partial survey of onset signature types at distances X less than 15 R(sub E) for the first five months (March-July 1995) of the Geotail near-Earth mission. During the second year, Geotail data from March 1995 to present were plotted. Various signatures at local onset were catalogued for the period through 1997. During this past year we performed a survey of current-disruption-like (CD-like) signatures at distances X less than or equal to 14 R(sub E) for the three years 1995-1997.
Author
Magnetic Storms; Data Bases; Plasma Layers

20030062786 NASA Ames Research Center, Moffett Field, CA, USA
The Biosphere: A Decadal Vision
Peterson, David L.; Curran, Paul J.; Mlynzcak, Marty; Miller, Richard; [2003]; 6 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France; Copyright; Avail: CASI; A02, Hardcopy

This paper focuses on biosphere-climate interactions including the influences of human activities. Recognizing this is only one aspect of biospheric processes, this places an emphasis of those biogeochemical processes that have a profound effect on numerous other aspects of the biosphere and the services it provides, services which are critical to sustaining life on Earth. And, the paper will focus on the various scientific aspects of assessing the availability of fresh water, including its sensitivity

to climate variance and land use changes. Finally, this paper hopes to emphasize the potential role that greatly expanded space observations and interactive modeling can play in developing our understanding of Earth and its the living systems.
Derived from text
Biogeochemistry; Biosphere; Periodic Variations; Ecosystems; Life Sciences

20030062838 Cincinnati Univ., OH, USA
Analysis of ALOHA-93 Campaign Data in Terms of Gravity and Tidal Wave Modes: Considerations on the Jet Stream as a Gravity-Wave Source
Tuan, T. F.; Dec. 29, 1999; 9 pp.; In English
Contract(s)/Grant(s): F19628-96-C-0028; Proj-2310
Report No.(s): AD-A412011; AFRL-VS-TR-2002-1603; No Copyright; Avail: CASI; A02, Hardcopy

We report on two particular phenomena observed in the ALOHA-93 Campaign. On 20 Oct 1993, the data showed a sudden sharp rise in temperature over an exceedingly narrow height range, with an initially modest temperature peak at 93 km rising to a peak value two hours later at a height of 88 km, then subsiding to a much smaller value near 87 km some 4-1/2 hours later. The second phenomenon is the simultaneous observation of OH airglow wave structure propagating along an azimuth of 340 deg with a phase speed of 35 m/s, a horizontal wavelength of 80 km remaining for the duration of temperature-inversion layer observation. Our analysis shows that a critical layer exists at about 87 km between the beginning of observation at 0830 UYT until after 1200 UT. By plotting The vertical gradient of horizontal wind we show that it has a maximum in the 340-160 deg direction. By plotting the Richardson number vs height, we show that the shear grows and becomes sufficiently large to initiate the KH instability only over a height range of 2 to 3 km centered at 87-88 km between 1000 and 1230 UT. We conclude that the source 0 energy and momentum for the temperature inversion layer and associated large wind shear observed near 88 km is a downward-propagating gravity wave interacting with the total background wind field, including the diurnal tide.
DTIC
Airglow; Gravity Waves; Jet Streams (Meteorology)

20030062938 California Univ., Los Angeles, CA, USA
Tracers of the Extraterrestrial Component in Sediments and Inferences for Earth's Accretion History
Kyte, Frank T.; January 2003; 18 pp.; In English
Contract(s)/Grant(s): NAG5-9411; No Copyright; Avail: CASI; A03, Hardcopy

The study of extraterrestrial matter in sediments began with the discovery of cosmic spherules during the HMS Challenger Expedition (1873-1876), but has evolved into a multidisciplinary study of the chemical, physical, and isotopic study of sediments. Extraterrestrial matter in sediments comes mainly from dust and large impactors from the asteroid belt and comets. What we know of the nature of these source materials comes from the study of stratospheric dust particles, cosmic spherules, micrometeorites, meteorites, and astronomical observations. The most common chemical tracers of extraterrestrial matter in sediments are the siderophile elements, most commonly iridium and other platinum group elements. Physical tracers include cosmic and impact spherules, Ni-rich spinels, meteorites, fossil meteorites, and ocean-impact melt debris. Three types of isotopic systems have been used to trace extraterrestrial matter. Osmium isotopes cannot distinguish chondritic from mantle sources, but provide a useful tool in modeling long-term accretion rates. Helium isotopes can be used to trace the long-term flux of the fine fraction of the interplanetary dust complex. Chromium isotopes can provide unequivocal evidence of an extraterrestrial source for sediments with high concentrations of meteoritic Cr. The terrestrial history of impacts, as recorded in sediments, is still poorly understood. Helium isotopes, multiple Ir anomalies, spherule beds, and craters all indicate a comet shower in the late Eocene. The Cretaceous-Tertiary boundary impact event appears to have been caused by a single carbonaceous chondrite projectile, most likely of asteroid origin. Little is known of the impact record in sediments from the rest of the Phanerozoic. Several impact deposits are known in the Precambrian, including several possible mega-impacts in the Early Archean.
Author
Extraterrestrial Matter; Sediments; Asteroid Belts; Dust; Micrometeorites; Spherules; Meteorites; Interplanetary Dust; Impactors

20030062981 California Univ., Los Angeles, CA, USA
Unmelted Meteoritic Debris Collected from Eltanin Ejecta in Polarstern Cores from Expedition ANT XII/4
Kyte, Frank T.; Deep-Sea Research II; January 2002; Volume 49, No. 49, pp. 1063-1071; In English
Contract(s)/Grant(s): NAG5-9411; NSF EAR-9418303; Copyright; Avail: Other Sources

A total of 1.7g of unmelted meteorite particles have been recovered from FS Polarstern piston cores collected on expedition ANT XII/4 that contain ejecta from the Eltanin impact event. Most of the mass (1.2 g) is a large, single specimen that is a polymict breccia, similar in mineralogy and chemistry to howardites or the silicate fraction of mesosiderites. Most of the remaining mass is in several large individual pieces (20-75mg each) that are polymict breccias, fragments dominated by pyroxene, and an igneous rock fragment. The latter has highly fractionated REE, similar to those reported in mafic clasts from mesosiderites. Other types of specimens identified include fragments dominated by maskelynite or olivine. These pieces of the projectile probably survived impact by being blown off the back surface of the Eltanin asteroid during its impact into the Bellingshausen Sea.
Author
Debris; Meteoritic Composition; Meteorites; Breccia; Pyroxenes; Igneous Rocks; Asteroids

20030062987 California Univ., Los Angeles, CA, USA
The Extraterrestrial Component in Sediments and Inferences on Earth's Accretion History
Kyte, Frank; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9441; No Copyright; Avail: CASI; A01, Hardcopy

The influx of extraterrestrial materials to the Earth is dominated by two size-fractions: sub-mm interplanetary dust and impacting asteroids and comets. This influx can be detected in sedimentary deposits as physical debris (cosmic spherules, meteorites), or as chemical or isotopic signals. The study of this extraterrestrial component in sediments began with the discovery of cosmic spherules in the magnetic fraction of deep-sea sediments collected during the expedition of the HMS Challenger (1873-1876). These were correctly interpreted to be produced by ablation of meteoritic material during atmospheric entry. Over the next 100 years work on extraterrestrial sediments was largely cosmic spherule studies. A notable exception was the first detection of a chemical signal when Barker and Anders found an inverse relationship between Ir concentrations (from meteoritic dust) and the accumulation rate of deep sea sediments. The first attempt to use this relationship to measure the accumulation rate of a sedimentary unit was a complete failure. Alvarez et a1 measured Ir in the Cretaceous/Tertiary (KT) boundary from Gubbio and found far too much Ir to be consistent with the Barker and Anders results. When Alvarez et al. suggested that this Ir anomaly was a signal of ejecta from an asteroid impact, rather than the slow accumulation of inter- planetary dust they set off scientific explosion and the second century of research into extraterrestrial sediments got off with a bang.
Derived from text
Extraterrestrial Matter; Sediments; Cretaceous-Tertiary Boundary; Interplanetary Dust; Meteoritic Composition; Asteroids

20030062994 NASA Langley Research Center, Hampton, VA, USA
Developing of a New Atmospheric Ionizing Radiation (AIR) Model
Clem, John M.; deAngelis, Giovanni; Goldhagen, Paul; Wilson, John W.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 370-375; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

As a result of the research leading to the 1998 AIR workshop and the subsequent analysis, the neutron issues posed by Foelsche et al. and further analyzed by Hajnal have been adequately resolved. We are now engaged in developing a new atmospheric ionizing radiation (AIR) model for use in epidemiological studies and air transportation safety assessment. A team was formed to examine a promising code using the basic FLUKA software but with modifications to allow multiple charged ion breakup effects. A limited dataset of the ER-2 measurements and other cosmic ray data will be used to evaluate the use of this code.
Author
Atmospheric Radiation; Ionizing Radiation; Atmospheric Models; Earth Atmosphere; Galactic Cosmic Rays

20030063031 California Univ., Los Angeles, CA, USA
The Disposition of Pt, Pd, Ir, Os, and Ru in Marine Sediments and the K/T Boundary
Lee, Cin-Ty; Wasserburg, Gerald; Kyte, Frank; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-9441; No Copyright; Avail: Other Sources; Abstract Only

The marine record of platinum group elements (PGEs) and Os isotopic compositions provides information on different inputs of PGEs into the oceans. Some studies based on a smaller subset of the PGEs suggest that the PGEs may suffer post-depositional mobility during diagenesis. In some K/T boundary clays, Kyte and others showed that the relative abundances of Pt, Pd, Ir, and Os can differ significantly from chondritic, which is the signature expected from fallout of the

meteorite impact. In some K/T boundary sections, elevated Ir concentrations are observed as far as 1 meter from the cm-thick boundary clay containing the meteoritic ejecta. The purpose of this study was to characterize Pt, Pd, Ir, Os, and Ru abundances in zones including the K/T boundary. We determined PGE abundances of boundary clays at two hemipelagic sites (Stevns Klint, Denmark and Caravaca, Spain) in which previous studies by Kyte and others showed that the Ir anomaly is confined to within a few cm. We also analyzed two pelagic Pacific sites: a boundary clay from the north Pacific (Hole 465A) characterized by a 0.5 m thick Ir anomaly and a transect across the K/T boundary from the south Pacific (Hole 596) where the Ir anomaly spans 2 m. The Stevns Klint, Caravaca, and north Pacific sites are characterized by abundant marls and limestones in the section, whereas the south Pacific site is dominated by clays. Samples were spiked with isotopic tracers, mixed with a flux, S and Ni, and equilibrated by fusion. PGEs were extracted from the Ni and analyzed on a Finnigan Element ICP-MS. We find that the narrow Caravaca and Stevns Klint boundary clays have relative PGE abundance patterns indistinguishable from chondritic values. The two Pacific sites were found to have nearly identical PGE patterns but have ratios at the peak, which differ from chondritic values as found earlier by Evans et al. The Pacific sites were found to have nearly identical PGE patterns but are extremely depleted in OS (Os/Ir = 0.07-0.15) and slightly enriched in Pd and Pt relative to Ir.

Author

Cretaceous-Tertiary Boundary; Platinum; Iridium; Palladium; Osmium; Rubidium; Deposition; Clays; Isotope Ratios

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030062022 National Space Science and Technology Center, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Error Analyses of the North Alabama Lightning Mapping Array (LMA)

Koshak, W. J.; Solokiewicz, R. J.; Blakeslee, R. J.; Goodman, S. J.; Christian, H. J.; Hall, J. M.; Bailey, J. C.; Krider, E. P.; Bateman, M. G.; Boccippio, D. J., et al.; [2003]; 1 pp.; In English; International Conference on Atmospheric Electricity ICAE 2003, 9-13 Jun. 2003, Versailles, France; Copyright; Avail: Other Sources; Abstract Only

Two approaches are used to characterize how accurately the North Alabama Lightning Mapping Array (LMA) is able to locate lightning VHF sources in space and in time. The first method uses a Monte Carlo computer simulation to estimate source retrieval errors. The simulation applies a VHF source retrieval algorithm that was recently developed at the NASA-MSFC and that is similar, but not identical to, the standard New Mexico Tech retrieval algorithm. The second method uses a purely theoretical technique (i.e., chi-squared Curvature Matrix theory) to estimate retrieval errors. Both methods assume that the LMA system has an overall rms timing error of 50ns, but all other possible errors (e.g., multiple sources per retrieval attempt) are neglected. The detailed spatial distributions of retrieval errors are provided. Given that the two methods are completely independent of one another, it is shown that they provide remarkably similar results, except that the chi-squared theory produces larger altitude error estimates than the (more realistic) Monte Carlo simulation.

Author

Error Analysis; Lightning; Very High Frequencies; Matrix Theory; Time Measurement

20030062025 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Rondonia Lightning Detection Network: Network Description, Science Objectives, Data Processing Archival/ Methodology, and Results

Blakeslee, R. J.; Bailey, J. C.; Pinto, O.; Athayde, A.; Renno, N.; Weidman, C. D.; [2003]; 1 pp.; In English; International Conference on Atmospheric Electricity 2003, 9-13 Jun. 2003, Versailles, France; Copyright; Avail: Other Sources; Abstract Only

A four station Advanced Lightning Direction Finder (ALDF) network was established in the state of Rondonia in western Brazil in 1999 through a collaboration of U.S. and Brazilian participants from NASA, INPE, INMET, and various universities. The network utilizes ALDF IMPACT (Improved Accuracy from Combined Technology) sensors to provide cloud-to-ground lightning observations (i.e., stroke/flash locations, signal amplitude, and polarity) using both time-of- arrival and magnetic direction finding techniques. The observations are collected, processed and archived at a central site in Brasilia and at the NASA/Marshall Space Flight Center in Huntsville, Alabama. Initial, non-quality assured quick-look results are made available in near real-time over the Internet. The network, which is still operational, was deployed to provide ground truth data for the Lightning Imaging Sensor (LIS) on the Tropical Rainfall Measuring Mission (TRMM) satellite that was launched in

November 1997. The measurements are also being used to investigate the relationship between the electrical, microphysical and kinematic properties of tropical convection. In addition, the long-time series observations produced by this network will help establish a regional lightning climatological database, supplementing other databases in Brazil that already exist or may soon be implemented. Analytic inversion algorithms developed at the NASA/Marshall Space Flight Center have been applied to the Rondonian ALDF lightning observations to obtain site error corrections and improved location retrievals. The data will also be corrected for the network detection efficiency. The processing methodology and the results from the analysis of four years of network operations will be presented.
Author
Cloud-To-Ground Discharges; Lightning; Time Series Analysis; Radio Direction Finders; Direction Finding; Convection

20030062095 NASA Marshall Space Flight Center, Huntsville, AL, USA
The North Alabama Lightning Mapping Array: Recent Results and Future Prospects
Goodman, S. J.; Blakeslee, R.; Christian, H.; Boccippio, D.; Koshak, W.; Bailey, J.; Hall, J.; Bateman, M.; McCaul, E.; Buechler, D., et al.; [2002]; 1 pp.; In English; International Commission on Atmospheric Electricity, 9-13 Jun. 2003, Versailles, France; No Copyright; Avail: Other Sources; Abstract Only

The North Alabama Lightning Mapping Array became operational in November 2001 as a principal component of a severe weather test bed to infuse new science and technologies into the short-term forecasting of severe and hazardous weather and the warning decision-making process. The LMA project is a collaboration among NASA scientists, National Weather Service (NWS) weather forecast offices (WFOs), emergency managers, and other partners. The time rate-of-change of storm characteristics and life-cycle trending are accomplished in real-time through the second generation Lightning Imaging Sensor Data Applications Display (LISDAD II) system, initially developed in T997 through a collaboration among NASA/MSFC, MIT/Lincoln Lab and the Melbourne, FL WFO. LISDAD II is now a distributed decision support system with a JAVA-based display application that allows anyone, anywhere to track individual storm histories within the Tennessee Valley region of the southeastern U.S. Since the inauguration of the LMA there has been an abundance of severe weather. During 23-24 November 2001, a major tornado outbreak was monitored by LMA in its first data acquisition effort (36 tornadoes in Alabama). Since that time the LMA has collected a vast amount of data on hailstorms and damaging wind events, non-tornadic supercells, and ordinary non-severe thunderstorms. In this paper we provide an overview of LMA observations and discuss future prospects for improving the short-term forecasting of convective weather.
Author
Lightning; Weather Forecasting; Thunderstorms; Decision Support Systems; Imaging Techniques; Storms; Tornadoes

20030062113 NASA Marshall Space Flight Center, Huntsville, AL, USA
Global Frequency and Distribution of Lightning as Observed from Space by the Optical Transient Detector
Christian, Hugh J.; Blakeslee, Richard J.; Boccippio, Dennis J.; Boeck, William L.; Buechler, Dennis E.; Driscoll, Kevin T.; Goodman, Steven J.; Hall, John M.; Koshak, William J.; Mach, Douglas M., et al.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D1; 15 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The Optical Transient Detector (OTD) is a space-based instrument specifically designed to detect and locate lightning discharges as it orbits the Earth. This instrument is a scientific payload on the MicroLab-1 satellite that was launched into a 70deg inclination low Earth orbit in April 1995. Given the orbital trajectory of the satellite, most regions of the Earth are observed by the OTD instrument more than 400 times during a 1 year period, and the average duration of each observation is 2 min. The OTD instrument optically detects lightning flashes that occur within its 1300 x 1300 sq km field of view during both day and night conditions. A statistical examination of OTD lightning data reveals that nearly 1.4 billion flashes occur annually over the entire Earth. This annual flash count translates to an average of 44 +/- 5 lightning flashes (intracloud and cloud-to-ground combined) occurring around the globe every second, which is well below the traditional estimate of 100 fl/s that was derived in 1925 from world thunder day records. The range of uncertainty for the OTD global totals represents primarily the uncertainty (and variability) in the flash detection efficiency of the instrument. The OTD measurements have been used to construct lightning climatology maps that demonstrate the geographical and seasonal distribution of lightning activity for the globe. An analysis of this annual lightning distribution confirms that lightning occurs mainly over land areas, with an average land/ocean ratio of approx. 10:1. The Congo basin, which stands out year-round, shows a peak mean annual flash density of 80 fl/sq km/yr in Rwanda, and includes an area of over 3 million km2 exhibiting flash densities greater than 30 fl/sq km/yr (the flash density of central Florida). Lightning is predominant in the northern Atlantic and western Pacific Ocean basins year-round where instability is produced from cold air passing over warm ocean water. Lightning is less frequent in the eastern tropical Pacific and Indian Ocean basins where the air mass is warmer. A dominant Northern Hemisphere

summer peak occurs in the annual cycle, and evidence is found for a tropically driven semiannual cycle.
Author
Lightning; Satellite-Borne Instruments; Cloud-To-Ground Discharges; Payloads; Climatology

20030062164 NASA Marshall Space Flight Center, Huntsville, AL, USA
Error Analyses of the North Alabama Lightning Mapping Array (LMA)
Koshak, W. J.; Solakiewicz, R. J.; Blakeslee, R. J.; Goodman, S. J.; Christian, H. J.; Hall, J. M.; Bailey, J. C.; Krider, E. P.; Bateman, M. G.; Boccippio, D. J., et al.; [2003]; 4 pp.; In English; 12th International Conference on Atmospheric Electricity, 9-14 Jun. 2003, Versailles, France; Copyright; Avail: CASI; A01, Hardcopy

Two approaches are used to characterize how accurately the North Alabama Lightning Mapping Array (LMA) is able to locate lightning VHF sources in space and in time. The first method uses a Monte Carlo computer simulation to estimate source retrieval errors. The simulation applies a VHF source retrieval algorithm that was recently developed at the NASA-MSFC and that is similar, but not identical to, the standard New Mexico Tech retrieval algorithm. The second method uses a purely theoretical technique (i.e., chi-squared Curvature Matrix theory) to estimate retrieval errors. Both methods assume that the LMA system has an overall rms timing error of 50ns, but all other possible errors (e.g., multiple sources per retrieval attempt) are neglected. The detailed spatial distributions of retrieval errors are provided. Given that the two methods are completely independent of one another, it is shown that they provide remarkably similar results, except that the chi-squared theory produces larger altitude error estimates than the (more realistic) Monte Carlo simulation.
Author
Lightning; Error Analysis; Monte Carlo Method; Root-Mean-Square Errors; Computerized Simulation

20030062188 NASA Marshall Space Flight Center, Huntsville, AL, USA
Global Lightning Activity
Christian, Hugh; [2003]; 1 pp.; In English; 12th International Conference on Atmospheric Electricity, 9-13 Jun. 2003, Versailles, France; No Copyright; Avail: Other Sources; Abstract Only

Our knowledge of the global distribution of lightning has improved dramatically since the 1995 launch of the Optical Transient Detector (OTD) followed in 1997 by the launch of the Lightning Imaging Sensor (LIS). Together, these instruments have generated a continuous seven-year record of global lightning activity. These lightning observations have provided a new global perspective on total lightning activity. For the first time, total lightning activity (CG and IC) has been observed over large regions with high detection efficiencies and accurate geographic location. This has produced new insights into lightning distributions, times of occurrence and variability. It has produced a revised global flash rate estimate (46 flashes per second) and has lead to a new realization of the significance of total lightning activity in severe weather. Accurate flash rate estimates are now available for large areas of the earth (+/- 72deg latitude) Ocean-land contrasts as a function of season are clearly revealed, as are orographic effects and seasonal and interannual variability. The data set indicates that air mass thunderstorms, not large storm systems dominate global activity. The ability of LIS and OTD to detect total lightning has lead to improved insight into the correlation between lightning and storm development. The relationship between updraft development and lightning activity is now well established and presents an opportunity for providing a new mechanism for remotely monitoring storm development. In this concept, lightning would serve as a surrogate for updraft velocity. It is anticipated hat this capability could lead to significantly improved severe weather warning times and reduced false warning rates.
Author
Lightning; Imaging Techniques; Thunderstorms; Air Masses; Correlation

20030062203 NASA Kennedy Space Center, Cocoa Beach, FL, USA
An Automated Cloud-edge Detection Algorithm Using Cloud Physics and Radar Data
Ward, Jennifer G.; Merceret, Francis J.; Grainger, Cedric A.; [2003]; 19 pp.; In English
Report No.(s): NASA/TM-2003-211189; No Copyright; Avail: CASI; A03, Hardcopy

An automated cloud edge detection algorithm was developed and extensively tested. The algorithm uses in-situ cloud physics data measured by a research aircraft coupled with ground-based weather radar measurements to determine whether the aircraft is in or out of cloud. Cloud edges are determined when the in/out state changes, subject to a hysteresis constraint. The hysteresis constraint prevents isolated transient cloud puffs or data dropouts from being identified as cloud boundaries. The algorithm was verified by detailed manual examination of the data set in comparison to the results from application of the automated algorithm.
Author
Cloud Physics; Automatic Control; Edge Detection; Radar Data; Meteorological Radar

20030062941 Hughes Technical Center, Atlantic City International Airport, NJ, USA

Juneau Airport Wind System (JAWS). Wind Sensor Severe Weather Performance Test Report

Benner, William; Carty, Thomas; McKinney, Michael; Law, Francis; Aug. 2002; 126 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410984; DOT/FAA/CT-TN02/18; No Copyright; Avail: CASI; A07, Hardcopy

The Weather Group of the Federal Aviation Administration (FAA) William J. Hughes Technical Center performed a wintertime assessment of wind sensors near Juneau International Airport (JNU), Alaska during the period November 2000-June 2001. The purpose of the field investigation was to assess the severe-weather performance capabilities of wind sensors currently used in the prototype JNU wind Hazard Information System (JWHIS) developed by the National Center for Atmospheric Research (NCAR). In addition, alternate heated anemometers including ultrasonic, mechanical, and pressure-type sensors were assessed as possible candidates for use in the operational successor to JWHIS, the Juneau Airport Wind System (JAWS). Pretest activities included wind sensor checkout and calibration in a wind tunnel at the Technical Center. A test bed was then set up on an existing equipment tower on a well-exposed mountain overlooking JNU. This ridge-top weather station has a suitable tower, equipment, and communications infrastructure to support installation and continuous operations of the test equipment. The site is subject to extreme meteorological and climatic conditions where snow and the buildup of rime ice on exposed surfaces can be substantial. Nine anemometers, all with heater capabilities, were installed along with other instrumentation including an ice detector, temperature/relative humidity probe, and Internet-capable video cameras. Data was acquired from the mountain via a high-speed wireless network in an unattended mode during the 6-month period. Continuous remote monitoring of sensor and video data was accomplished via a server with Web and FTP capabilities.

DTIC

Anemometers; Wind Tunnels; Wind Measurement; Airports

20030063062 Army Research Lab., White Sands Missile Range, NM, USA

Short-Term Battlescale Forecast Model Performance Incorporating Utah Mesonet Stations

Sauter, Barbara; Henmi, Teizi; Feb. 2003; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411641; ARL-TR-2810; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Army requires accurate short-term weather forecasts in order to optimize the use of personnel and systems in mission execution in a wide variety of locations and conditions. This study investigates the performance of the Battlescale Forecast Model over an area of complex terrain by comparing results of model runs incorporating surface observations from Utah mesonet stations with equivalent model runs made without any surface data.

DTIC

Weather Forecasting; Models

20030063073 NASA Ames Research Center, Moffett Field, CA, USA

Lightning and Other Influences On Tropical Tropospheric Ozone: Empirical Studies of Covariation

Chatfield, Robert B.; Guan, Hong; Hudson, Robert D.; Witte, Jacquelyne C.; [2003]; 1 pp.; In English; International Union of Geodesy and Geophysics General Assembly, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; Copyright; Avail: Other Sources; Abstract Only

Tropical and subtropical tropospheric ozone are important radiatively active species, with particularly large effects in the upper third of the troposphere. Temporal variability of O3 has proved difficult to simulate day by day in process models. Thus, individual roles of lightning, biomass burning, and other pollution in providing precursor NO(x), radicals, and chain carriers (CO, hydrocarbons) remain unquantified by simulation, and it is theoretically reasonable that individual roles are magnified by a joint synergy. We use wavelet analysis and Burg-algorithm maximum entropy spectral analyses to describe time-scales and correlation of ozone with proxies for processes controlling its concentration. Our empirical studies link time variations apparent in several datasets: the SHADOZ (Southern Hemisphere Additional Ozonesondes) network stations (Nairobi, Fiji), and auxiliary series with power to explain ozone-determining processes, with some interpretation based on the TTO (Tropical Tropospheric Ozone) product derived from TOMS (the Total Ozone Mapping Spectrometer). The auxiliary series are The OTD/LIS(Optical Transient Detector/Lightning Imaging Sensor) measurements of the lightning NO(x) source, the OLR (Outgoing Longwave Radiation)measurement of high-topped clouds, and standard meteorological variables from the USA NCEP (National Centers for Environmental Prediction) and Data Assimilation Office analyses. Concentrating on equatorial ozone, we compare the statistical evidence on the variability of tropospheric ozone. Important variations occur on approximately two-week, two-month (Madden-Julian Oscillation) and annual scales, and relations with OLR suggest controls associated with continental clouds. Hence we are now using the Lightning Imaging Sensor data set to indicate NO(x) sources.

We report initial results defining relative roles of the process mentioned affecting O3 using their covariance properties. Author

Total Ozone Mapping Spectrometer; Troposphere; Ozone; Meteorological Parameters; Lightning

20030063120 NASA Marshall Space Flight Center, Huntsville, AL, USA

ACES: A Unique Platform For Electrodynamic Studies Of Upward Currents into The Middle Atmosphere

Farrell. W. M.; Goldberg, R. A.; Desch, M. D.; Blakesles, R. J.; Houser, J. G.; Mitchell, J. D.; Crosky, C. L.; Mach, D. M.; Bailey, J. C.; [2003]; 1 pp.; In English; International Conference on Atmospheric Electricity 2003, 9-13 Jun. 2003, Versailles, France; Copyright; Avail: Other Sources

Recent research has helped identify, define, and describe the occurrence of transient electrical bursts such as jets and sprites (approx.10-20 ms duration) in the stratosphere and mesosphere during tropospheric electrical storms. However, it is critical to make in situ measurements within the active electrical region for the primary purpose of understanding the currents responsible for the luminous events, to develop a proper understanding of their cause(s), and of their impact on the atmospheric electromagnetic environment. The transfer of significant quantities of energy between the lower and upper atmosphere during tropospheric electrical storms has long been suspected but never verified until the identification of these type phenomena. It has become important to develop measuring system which can be used to determine the mechanisms responsible for generating these events, to make a better appraisal of their role and importance in the electrical structure of the atmosphere. The use of unmanned aerial vehicles (UAV) such as ALTUS provides a unique and valuable approach for obtaining the desired information. An important objective of The ALTUS Cumulus Electrification Study (ACES) was to monitor the electromagnetic state of the atmosphere during electrically active (thunderstorm) periods. The program involved several flights of a payload designed to continuously measure for extended periods the electromagnetic structure near and above thunderstorms. It was conducted at the Naval Air Station in Key West, FL during August, 2002.The payload contained instrumentation to measure the time varying and steady state three dimensional vectors for electric (slow antenna and field mills) and magnetic fields (search coils and magnetometer), as well as a Gerdien probe to measure electrical conductivity. The data acquisition system aboard the payload permitted acquisition of short-term bursts with a few microsecond resolution. Author

Electrical Resistivity; Magnetic Fields; Electric Fields; Thunderstorms; Stratosphere; Troposphere

20030063148 NASA Langley Research Center, Hampton, VA, USA, Dalhousie Univ., Halifax, Nova Scotia, Canada

A New Statistically based Autoconversion rate Parameterization for use in Large-Scale Models

Lin, Bing; Zhang, Junhua; Lohmann, Ulrike; Journal of Geophysical Research; [2002]; Volume 107, No. D24, 4750, pp. 3-1 - 3-16; In English; Copyright; Avail: CASI; A03, Hardcopy

The autoconversion rate is a key process for the formation of precipitation in warm clouds. In climate models, physical processes such as autoconversion rate, which are calculated from grid mean values, are biased, because they do not take subgrid variability into account. Recently, statistical cloud schemes have been introduced in large-scale models to account for partially cloud-covered grid boxes. However, these schemes do not include the in-cloud variability in their parameterizations. In this paper, a new statistically based autoconversion rate considering the in-cloud variability is introduced and tested in three cases using the Canadian Single Column Model (SCM) of the global climate model. The results show that the new autoconversion rate improves the model simulation, especially in terms of liquid water path in all three case studies. Author

Precipitation (Meteorology); Cloud Physics; Atmospheric Models; Variability; Climate Models

20030063154 Ohio Aerospace Inst., Brook Park, OH, USA

Ice-Accretion Scaling Using Water-Film Thickness Parameters

Anderson, David N.; Feo, Alejandro; June 2003; 19 pp.; In English; 40th Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-884; WU-708-20-13

Report No.(s): NASA/CR-2003-211826; AIAA-2002-0522; E-13519; NAS 1.26:211826; Copyright; Avail: CASI; A03, Hardcopy

Studies were performed at INTA in Spain to determine water-film thickness on a stagnation-point probe inserted in a simulated cloud. The measurements were correlated with non-dimensional parameters describing the flow and the cloud conditions. Icing scaling tests in the NASA Glenn Icing Research Tunnel were then conducted using the Ruff scaling method with the scale velocity found by matching scale and reference values of either the INTA non-dimensional water-film thickness

or a Weber number based on that film thickness. For comparison, tests were also performed using the constant drop-size Weber number and the average-velocity methods. The reference and scale models were both aluminum, 61-cm-span, NACA 0012 airfoil sections at 0 deg. AOA. The reference had a 53-cm-chord and the scale, 27 cm (1/2 size). Both models were mounted vertically in the center of the IRT test section. Tests covered a freezing fraction range of 0.28 to 1.0. Rime ice (n = 1.0) tests showed the consistency of the IRT calibration over a range of velocities. At a freezing fraction of 0.76, there was no significant difference in the scale ice shapes produced by the different methods. For freezing fractions of 0.40, 0.52 and 0.61, somewhat better agreement with the reference horn angles was typically achieved with the average-velocity and constant-film thickness methods than when either of the two Weber numbers was matched to the reference value. At a freezing fraction of 0.28, the four methods were judged equal in providing simulations of the reference shape.
Author
Ice Formation; Water; Film Thickness; Scale Models

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20030063109 Maryland Univ. Baltimore County, Catonsville, MD, USA
[Activities of Goddard Earth Sciences and Technology Center, Maryland University]
[2003]; 25 pp.; In English
Contract(s)/Grant(s): NCC5-494; No Copyright; Avail: CASI; A03, Hardcopy

The Goddard Space Flight Center (GSFC) is recognized as a world leader in the application of remote sensing and modeling aimed at improving knowledge of the Earth system. The Goddard Earth Sciences Directorate plays a central role in NASA's Earth Observing System and the U.S. Global Change Research Program. Goddard Earth Sciences and Technology (GEST) is organized as a cooperative agreement with the GSFC to promote excellence in the Earth sciences, and is a consortium of universities and corporations (University of Maryland Baltimore County, Howard University, Hampton University, Caelum Research Corporation and Northrop Grumman Corporation). The aim of this new program is to attract and introduce promising students in their first or second year of graduate studies to Oceanography and Earth system science career options through hands-on instrumentation research experiences on coastal processes at NASA's Wallops Flight Facility on the Eastern Shore of Virginia.
Derived from text
Earth Sciences; NASA Programs; Oceanography; Remote Sensing; Technologies

20030063126 California Univ., Los Angeles, CA, USA
Oceanic Impacts: A Growing Field of Fundamental Geoscience
Gersonde, Rainer; Deutsch, Alexander; Ivanov, Boris A.; Kyte, Frank T.; Deep Sea Research Part II; 2002; ISSN 0967-0645; Volume 49, pp. 951-957; In English
Contract(s)/Grant(s): NAG5-9441; Copyright; Avail: Other Sources

The importance of oceanic impacts of collisional events and resulting energy release, are briefly described. Data collection methods from the Eltanin (a mesosiderite projectile) deep water impact, are presented.
CASI
Asteroid Collisions; Cometary Collisions; Meteorite Collisions; Projectile Cratering; Environment Effects; Craters

20030063139 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Volume 6, Special Topics in Ocean Optics Protocols and Appendices
Mueller, J. L., Editor; Fargion, Giulietta S., Editor; McClain, Charles R., Editor; April 2003; 151 pp.; In English; See also 20030063140 - 20030063145; Original contains black and white illustrations
Report No.(s): NASA/TM-2003-211621/VOL6/REV4; Rept-2003-01674-0/VOL6/REV4; NAS 1.15:211621/VOL6/REV4; No Copyright; Avail: CASI; A08, Hardcopy

This document stipulates protocols for measuring bio-optical and radiometric data for the Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) Project activities and algorithm development. The document is organized into 6 separate volumes as Ocean Optics Protocols for Satellite Ocean Color Sensor Validation,

Revision 4. Volume I: Introduction, Background and Conventions; Volume II: Instrument Specifications, Characterization and Calibration; Volume III: Radiometric Measurements and Data Analysis Methods; Volume IV: Inherent Optical Properties: Instruments, Characterization, Field Measurements and Data Analysis Protocols; Volume V: Biogeochemical and Bio-Optical Measurements and Data Analysis Methods; Volume VI: Special Topics in Ocean Optics Protocols and Appendices. The earlier version of Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 3 (Mueller and Fargion 2002, Volumes 1 and 2) is entirely superseded by the six volumes of Revision 4 listed above.
Author
Oceanography; Radiometers; Optical Measuring Instruments; Water Color; Sensors; Biogeochemistry; Protocol (Computers)

20030063140 San Diego State Univ., San Diego, CA, USA
Introduction to Special Topics in Ocean Optics for Ocean Color Sensor Validation
Mueller, James L.; Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Volume VI: Special Topics in Ocean Optics Protocols and Appendices; April 2003, pp. 1-2; In English; See also 20030063139; No Copyright; Avail: CASI; A01, Hardcopy

The overall purpose of the ocean optics protocols document is to provide the ocean color community with guidance for acquiring in situ data needed to develop algorithms and validate the performance of, and biogeochemical data sets derived from, satellite ocean color sensors. The first five volumes of this document first identify necessary and desired oceanic and atmospheric variables and appropriate instruments to measure them. Methods for characterizing and calibrating those instruments are covered next. Finally, detailed methods are described for measuring each category of variables at sea, and for processing and analyzing the data, to derive the essential information needed for all aspects of satellite ocean color validation.
Author
Oceans; Protocol (Computers); Water Color; Algorithms; Biogeochemistry

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20030062080 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Proposed Mechanism for the Thermal Denaturation of a Recombinant Bacillus Halmapalus Alpha-amylase - the Effect of Calcium Ions
Nielsen, Anders D.; Pusey, Marc L.; Fuglsang, Claus C.; Westh, Peter; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The thermal stability of a recombinant alpha-amylase from Bacillus halmapalus alpha-amylase (BHA) has been investigated using circular dichroism spectroscopy (CD) and differential scanning calorimetry (DSC). This alpha-amylase is homologous to other Bacillus alpha-amylases where previous crystallographic studies have identified the existence of 3 calcium binding sites in the structure. Denaturation of BHA is irreversible with a Tm of approximately 89 C, and DSC thermograms can be described using a one-step irreversible model. A 5 C increase in T(sub m) in the presence of 10 fold excess CaCl2 was observed. However, a concomitant increase in the tendency to aggregate was also observed. The presence of 30-40 fold excess calcium chelator (EDTA or EGTA) results in a large destabilization of BHA corresponding to about 40 C lower T(sub m), as determined by both CD and DSC. Ten fold excess EGTA reveals complex DSC thermograms corresponding to both reversible and irreversible transitions, which possibly originate from different populations of BHA:calcium complexes. The observations in the present study have, in combination with structural information of homologous alpha-amylases, provided the basis for the proposal of a simple denaturation mechanism of BHA. The proposed mechanism describes the irreversible thermal denaturation of different BHA:calcium complexes and the calcium binding equilibrium involved. Furthermore, the model accounts for a temperature induced reversible structural change associated with calcium binding.
Author
Calcium; Bacillus; Thermal Stability; Positive Ions; Temperature Measuring Instruments; Ethylenediaminetetraacetic Acids; Chemical Bonds

20030062787 NASA Ames Research Center, Moffett Field, CA, USA

Hypergravity Stimulates the Extracellular Matrix/Integrin-Signaling Axis and Proliferation in Primary Osteoblasts

Parra, M.; Vercoutere, W.; Roden, C.; Banerjee, I.; Krauser, W.; Holton, E.; Searby, N.; Globus, R.; Almeida, E.; [2003]; 1 pp.; In English; The ASBMR(Association ofBone and Mineral Research) 25th Annual Meeting and Anniversary Celebration, 19-23 Sep. 2003, Minneapolis, MN, USA; No Copyright; Avail: Other Sources; Abstract Only

We set out to determine the molecular mechanisms involved in the proliferative response of primary rat osteoblasts to mechanical stimulation using cell culture centrifugation as a model for hypergravity. We hypothesized that this proliferative response is mediated by specific integrin/Extracellular Matrix (ECM) interactions. To investigate this question we developed a cell culture centrifuge and an automated system that performs cell fixation during hypergravity loading. We generated expression vectors for various focal adhesion and cytoskeletal proteins fused to GFP or dsRed and visualized these structures in transfected (or infected) osteoblasts. The actin cytoskeleton was also visualized using rhodamine-phalloidin staining and Focal Adhesion Kinase (FAK) levels were assessed biochemically. We observed that a 24 hour exposure to 50-g stimulated proliferation compared to the 1-g control when cells were plated on fibronectin, collagen Type I , and collagen Type IV, but not on uncoated tissue culture plastic surfaces. This proliferative response was greatest for osteoblasts grown on fibronectin (2-fold increase over 1-g control) and collagen Type I (1.4 fold increase over 1-g control), suggesting that specific matrices and integrins are involved in the signaling pathways required for proliferation. Exposing osteoblasts grown on different matrices to 10-g or 25-g showed that effects on proliferation depended on both matrix type and loading level. We found that osteoblasts exposed to a short pulse of hypergravity during adhesion spread further and had more GFP-FAK containing focal adhesions compared to their 1-g controls. While overall levels of FAK did not change, more FAK was in the active (phosphorylated) form under hypergravity than in the 1-g controls. Cytoskeletal F-actin organization into filaments was also more prominent after brief exposures to hypergravity during the first five minutes of adhesion. These results suggest that specific integrins sense hypergravity and activate distinct matrix-dependent FAK signaling pathways that can enhance proliferation. Our results also imply that brief exposures to hypergravity accelerate cell adhesion and spreading processes via the focal adhesion-signaling axis. These results support the role of the ECM/integrin-signaling axis in osteoblast response to hypergravity loading.

Author

Osteoblasts; High Gravity Environments; Cells (Biology); Rhodamine; Rats

20030063019 NASA Langley Research Center, Hampton, VA, USA

A Survey of Logic Formalisms to Support Mishap Analysis

Johnson, Chris; Holloway, C. M.; Reliability Engineering and System Safety; 2003; ISSN 0951-8320; Volume 80, pp. 271-291; In English; Copyright; Avail: Other Sources

Mishap investigations provide important information about adverse events and near miss incidents. They are intended to help avoid any recurrence of previous failures. Over time, they can also yield statistical information about incident frequencies that helps to detect patterns of failure and can validate risk assessments. However, the increasing complexity of many safety critical systems is posing new challenges for mishap analysis. Similarly, the recognition that many failures have complex, systemic causes has helped to widen the scope of many mishap investigations. These two factors have combined to pose new challenges for the analysis of adverse events. A new generation of formal and semi-formal techniques have been proposed to help investigators address these problems. We introduce the term mishap logics to collectively describe these notations that might be applied to support the analysis of mishaps. The proponents of these notations have argued that they can be used to formally prove that certain events created the necessary and sufficient causes for a mishap to occur. These proofs can be used to reduce the bias that is often perceived to effect the interpretation of adverse events. Others have argued that one cannot use logic formalisms to prove causes in the same way that one might prove propositions or theorems. Such mechanisms cannot accurately capture the wealth of inductive, deductive and statistical forms of inference that investigators must use in their analysis of adverse events. This paper provides an overview of these mishap logics. It also identifies several additional classes of logic that might also be used to support mishap analysis.

Author

Safety; Risk; Accident Investigation; Accidents

20030063123 Army Aviation and Missile Command, Moffett Field, CA, USA

Objective Situation Awareness Measurement Based on Performance Self-Evaluation

DeMaio, Joe; December 15, 1998; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The research was conducted in support of the NASA Safe All-Weather Flight Operations for Rotorcraft (SAFOR) program. The purpose of the work was to investigate the utility of two measurement tools developed by the British Defense

Evaluation Research Agency. These tools were a subjective workload assessment scale, the DRA Workload Scale and a situation awareness measurement tool. The situation awareness tool uses a comparison of the crew's self-evaluation of performance against actual performance in order to determine what information the crew attended to during the performance. These two measurement tools were evaluated in the context of a test of innovative approach to alerting the crew by way of a helmet mounted display. The situation assessment data are reported here. The performance self-evaluation metric of situation awareness was found to be highly effective. It was used to evaluate situation awareness on a tank reconnaissance task, a tactical navigation task, and a stylized task used to evaluated handling qualities. Using the self-evaluation metric, it was possible to evaluate situation awareness, without exact knowledge the relevant information in some cases and to identify information to which the crew attended or failed to attend in others.
Author
Workloads (Psychophysiology); Performance Tests; All-Weather Landing Systems; All-Weather Air Navigation; Evaluation

20030063129 QSS Group, Inc., Moffett Field, CA, USA
Holarchical Systems and Emotional Holons : Biologically-Inspired System Designs for Control of Autonomous Aerial Vehicles
Ippolito, Corey; Plice, Laura; Pisanich, Greg; [2003]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The BEES (Bio-inspired Engineering for Exploration Systems) for Mars project at NASA Ames Research Center has the goal of developing bio-inspired flight control strategies to enable aerial explorers for Mars scientific investigations. This paper presents a summary of our ongoing research into biologically inspired system designs for control of unmanned autonomous aerial vehicle communities for Mars exploration. First, we present cooperative design considerations for robotic explorers based on the holarchical nature of biological systems and communities. Second, an outline of an architecture for cognitive decision making and control of individual robotic explorers is presented, modeled after the emotional nervous system of cognitive biological systems. Keywords: Holarchy, Biologically Inspired, Emotional UAV Flight Control
Author
Bioengineering; Flight Control; Decision Making; Robotics

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20030062149 Gdansk Technical Univ.
Investigation of Skin Burns Basing on Active Thermography
Kaczmarek, M.; Nowakowski, A.; Renkielska, A.; Grudzinski, J.; Stojek, W.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412047; No Copyright; Avail: CASI; A01, Hardcopy

Use of the dynamic thermography for assessment of burns is discussed. Animal in-vivo experiments are presented - sets of burns were inflicted on the backs of eight domestic pigs. Thermographic measurements of burns with different depth of affected tissue (from the first to the third-degree burns) are correlated with histopathologic analysis of lesions. The results show that dynamic thermography might be advice as a simple, non-invasive and non-stressed for patients diagnostic tool. Further analysis of dynamic pictures gives the first estimate of the depth of a lesion.
DTIC
Thermography; Burns (Injuries)

20030062829 NASA Kennedy Space Center, Cocoa Beach, FL, USA
In-Vessel Composting of Simulated Long-Term Missions Space-Related Solid Wastes
Rodriguez-Carias, Abner A.; Sager, John; Krumins, Valdis; Strayer, Richard; Hummerick, Mary; Roberts, Michael S.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 131-138; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Reduction and stabilization of solid wastes generated during space missions is a major concern for the Advanced Life Support - Resource Recovery program at the NASA, Kennedy Space Center. Solid wastes provide substrates for pathogen proliferation, produce strong odor, and increase storage requirements during space missions. A five periods experiment was

conducted to evaluate the Space Operation Bioconverter (SOB), an in vessel composting system, as a biological processing technology to reduce and stabilize simulated long-term missions space related solid-wastes (SRSW). For all periods, SRSW were sorted into components with fast (FBD) and slow (SBD) biodegradability. Uneaten food and plastic were used as a major FBD and SBD components, respectively. Compost temperature (C), CO2 production (%), mass reduction (%), and final pH were utilized as criteria to determine compost quality. In period 1, SOB was loaded with a 55\% FBD: 45\% SBD mixture and was allowed to compost for 7 days. An eleven day second composting period was conducted loading the SOB with 45\% pre-composted SRSW and 55\% FBD. Period 3 and 4 evaluated the use of styrofoam as a bulking agent and the substitution of regular by degradable plastic on the composting characteristics of SRSW, respectively. The use of ceramic as a bulking agent and the relationship between initial FBD mass and heat production was investigated in period 5. Composting SRSW resulted in an acidic fermentation with a minor increase in compost temperature, low CO2 production, and slightly mass reduction. Addition of styrofoam as a bulking agent and substitution of regular by biodegradable plastic improved the composting characteristics of SRSW, as evidenced by higher pH, CO2 production, compost temperature and mass reduction. Ceramic as a bulking agent and increase the initial FBD mass (4.4 kg) did not improve the composting process. In summary, the SOB is a potential biological technology for reduction and stabilization of mission space-related solid wastes. However, the success of the composting process may depend of the physical characteristics (particle size, porosity, structure, texture) of the SBD components which would require pre-processing of solid wastes before placing them in the SOB.
Author
Solid Wastes; Space Missions; Computerized Simulation; Biotechnology; Composting; Stability

20030062897 Army Research Inst. of Environmental Medicine, Natick, MA, USA
Carbohydrate Supplementation Improves Time-Trial Cycle Performance at 4300 m Altitude
Fulco, Charles S.; Kambis, K. W.; Friedlander, A. L.; Rock, P. B.; Staab, J. E.; Feb. 2003; 49 pp.; In English
Report No.(s): AD-A411927; USARIEM/TMMD-T03-7; No Copyright; Avail: CASI; A03, Hardcopy

Carbohydrate supplementation (CHOS) during prolonged (> 1 hr) heavy cycle exercise at sea level (SL) enhances glucose availability and oxidation, allowing performance at higher work rates compared to control. However, at altitude (ALT) , hypoxemia exacerbated by exercise may limit work rate increases and time-trial cycle performance improvements with CHOS. The purpose of this study was to determine if CHOS improves performance at ALT.
DTIC
Exercise Physiology; Human Performance

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20030062156 NASA Marshall Space Flight Center, Huntsville, AL, USA
Maximally Expressive Modeling of Operations Tasks
Jaap, John; Richardson, Lea; Davis, Elizabeth; [2002]; 10 pp.; In English; IEEE Aerospace Conference, 8-15 Mar. 2003, Big Sky, MT, USA; No Copyright; Avail: CASI; A02, Hardcopy

Planning and scheduling systems organize 'tasks' into a timeline or schedule. The tasks are defined within the scheduling system in logical containers called models. The dictionary might define a model of this type as 'a system of things and relations satisfying a set of rules that, when applied to the things and relations, produce certainty about the tasks that are being modeled.' One challenging domain for a planning and scheduling system is the operation of on-board experiments for the International Space Station. In these experiments, the equipment used is among the most complex hardware ever developed, the information sought is at the cutting edge of scientific endeavor, and the procedures are intricate and exacting. Scheduling is made more difficult by a scarcity of station resources. The models to be fed into the scheduler must describe both the complexity of the experiments and procedures (to ensure a valid schedule) and the flexibilities of the procedures and the equipment (to effectively utilize available resources). Clearly, scheduling International Space Station experiment operations calls for a 'maximally expressive' modeling schema.
Author
Schedules; Scheduling; Operations

20030062208 University Hospital, Cardiff, UK

An Instrument for the Bedside Quantification of Spasticity: A Pilot Study

Hughes, T.; Western, B. J.; Thomas, M.; van Deursen, R.; Griffiths, H.; 25 Oct. 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411814; No Copyright; Avail: CASI; A01, Hardcopy

Spasticity is a velocity-dependent phenomenon; the quicker the limb is moved the more resistance is encountered. A compact, portable instrument was constructed for recording the angle at the knee, the rate of change of angle (angular velocity) and the force encountered at the ankle when the limb was flexed. A pilot study was performed on 5 normal volunteers and 5 patients with spasticity. A preliminary index of spasticity was extracted from the measurements, being 0. 163+/-0.059 N.s/deg (mean+/-SD) for the patients and 0. 052+/-0.030 N.s/deg for the normal group.

DTIC

Knee (Anatomy); Sensorimotor Performance; Efferent Nervous System

20030062296 Sytronics, Inc., Dayton, OH

Summary Statistics and HGU-55/P Feature Envelopes for the 1990 USAF anthropometric Survey

Whitestone, Jennifer J.; Zehner, Gregory F.; Mountjoy, Daniel J.; Blackwell, Sherri U.; Gross, Mary E.; Apr. 1998; 92 pp.; In English

Contract(s)/Grant(s): F41624-93-C-6001; Proj-7184

Report No.(s): AD-A412018; AFRL-HE-WP-TR-2002-0172; No Copyright; Avail: CASI; A05, Hardcopy

This report describes an anthropometric survey of 365 USAF flyers conducted in 1990 at four military bases, including Ellsworth AFB, South Dakota; Randolph AFB, Texas; Eglin AFB, Florida; and Hurlburt Field, Florida. The survey included both traditional measurement data on the whole body, such as stature and thumbtip-reach, and three-dimensional (3-D) anthropometry acquired on the head and face. Surface scans of the flyers with and without their helmets were acquired to provide a database for cranio-facial design applications. The scans were used to establish feature envelopes for the HGU-55/P helmet. This report documents the 3-D relationship between anatomical features and equipment for a population of USAF flyers wearing the HGU-55/P helmet.

DTIC

Anthropometry; Helmets; Flight Clothing

20030062921 Hiroshima Inst. of Tech., Japan

A Microcomputer-Based Life-Safety Monitoring System for Elderly People

Maki, Hiromichi; Yonezawa, Yoshiharu; Ogawa, Hidekuni; Ninomiya, Ishio; Sada, Kouji; Oct. 25, 2001; 5 pp.; In English

Report No.(s): AD-A411900; No Copyright; Avail: CASI; A01, Hardcopy

A new safety and life support system has been developed for monitoring health conditions and daily living activities of solitary elderly people. The system employs a piezoelectric sensor, two low-power active filters, a low-power 8-hit single chip microcomputer (SCM) and a 315 MHz radio transmitter. The body movements produced by respiration, heartbeat, sleep/rest motions, walking and running are detected by the piezoelectric sensor, and the recorded motion signals are inputted to the SMC. If the patient is inactive for 64 minutes, then the SMC detects this emergency situation and informs the patient's family, a fire station or a hospital via telephone. The system is powered by a small 3V lithium battery which provides 14 days of continuous operation.

DTIC

Life Support Systems; Microcomputers

20030062933 Defence Research and Development Canada, Ottawa, Ontario, Canada

The Effects of Individual Differences in Cognitive Styles on decision-Making Accuracy and Latency

Blais, Ann-Renee; Thompson, Megan M.; Baranski, Joseph V.; Feb. 2003; 41 pp.; In English

Report No.(s): AD-A412182; DRDC-TR-2003-023; No Copyright; Avail: CASI; A03, Hardcopy

How might individuals' typical decision-making styles affect the quality and latency of their decisions? In a first study, 48 adults completed three measures of cognitive styles, including the Personal Need for Structure and Personal Fear of Invalidity scales (PNS and PFI; Thompson, Naccarato, Parker, & Moskowitz, 2001), and the Need for Cognition scale (NFC; Cacioppo & Petty, 1982) . Participants then completed three trials of a medium-fidelity simulation of a naval surveillance and threat assessment task called TITAN (i.e., 'Team and Individual Threat Assessment Network') that required participants to evaluate seven pieces of information for potential targets displayed in a radar space (e. g., direction, speed, bearing, etc.). After

reviewing the information for each target, participants submitted their threat assessment and were provided feedback about the degree of actual threat for the target. For each session, participants were instructed to clear the radar space of as many targets as possible within a 25-minute period and to perform this operation as accurately as possible. Results showed a significant decrease in processing time across trials. Higher NFC scores predicted a significantly smaller mean decision error across trials, and higher PNS scores predicted a greater mean decision error, although the latter effect failed to reach statistical significance. None of the cognitive styles scores had a significant main effect on the mean time spent processing TITAN targets. In Study 2, 80 Canadian Forces personnel completed the three cognitive styles measures and worked in four-person teams on TANDEM 11, a simulation similar to TITAN. Each team consisted of three subordinates who separately reviewed and integrated five pieces of complex information per target before forwarding their individual threat assessments to a team leader. The team leader then assessed the veridicality of the three assessments and integrated them into a final threat assessment for each7
DTIC
Cognition; Perception; Physiology; Aptitude; Data Transmission

20030063076 Army Aviation and Missile Command, Moffett Field, CA, USA
A Comparison of the AVS-9 and the Panoramic Night Vision Goggles During Rotorcraft Hover and Landing
Szoboszlay, Zoltan; Haworth, Loran; Simpson, Carol; [2000]; 10 pp.; In English; American Helicopter Society 57th Annual Forum, 9-11 May 2001, Washington, DC, USA; Copyright; Avail: CASI; A02, Hardcopy

A flight test was conducted to assess any differences in pilot-vehicle performance and pilot opinion between the use of a current generation night vision goggle (the AVS-9) and one variant of the prototype panoramic night vision goggle (the PNVGII). The panoramic goggle has more than double the horizontal field-of-view of the AVS-9, but reduced image quality. Overall the panoramic goggles compared well to the AVS-9 goggles. However, pilot comment and data are consistent with the assertion that some of the benefits of additional field-of-view with the panoramic goggles were negated by the reduced image quality of the particular variant of the panoramic goggles tested.
Author
Goggles; Night Vision; Flight Tests; Image Resolution; Pilot Performance

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20030062165 NASA Ames Research Center, Moffett Field, CA, USA
Hiproofs
Denney, Ewen; Power, John; [2003]; 17 pp.; In English; Computer Science Logic 2003, 25-30 Aug. 2003, Vienna, Austria
Contract(s)/Grant(s): GR/M45030; GR/M566333; GR/N12480; Copyright; Avail: CASI; A03, Hardcopy

We introduce a hierarchical notion of formal proof, useful in the implementation of theorem provers, which we call highproofs. Two alternative definitions are given, motivated by existing notations used in theorem proving research. We define transformations between these two forms of hiproof, develop notions of underlying proof, and give a suitable definition of refinement in order to model incremental proof development. We show that our transformations preserve both underlying proofs and refinement. The relationship of our theory to existing theorem proving systems is discussed, as is its future extension.
Author
Theorem Proving; Computer Programs; Mathematical Models; Hierarchies

20030063172 NASA Langley Research Center, Hampton, VA, USA
Dynamically Reconfigurable Approach to Multidisciplinary Problems
Alexandrov, Natalie M.; Lewis, Robert Michael; [2003]; 10 pp.; In English
Contract(s)/Grant(s): NCC1-02029
Report No.(s): AIAA Paper 2003-3431; Copyright; Avail: CASI; A02, Hardcopy

The complexity and autonomy of the constituent disciplines and the diversity of the disciplinary data formats make the task of integrating simulations into a multidisciplinary design optimization problem extremely time-consuming and difficult. We propose a dynamically reconfigurable approach to MDO problem formulation wherein an appropriate implementation of the disciplinary information results in basic computational components that can be combined into different MDO problem

formulations and solution algorithms, including hybrid strategies, with relative ease. The ability to re-use the computational components is due to the special structure of the MDO problem. We believe that this structure can and should be used to formulate and solve optimization problems in the multidisciplinary context. The present work identifies the basic computational components in several MDO problem formulations and examines the dynamically reconfigurable approach in the context of a popular class of optimization methods. We show that if the disciplinary sensitivity information is implemented in a modular fashion, the transfer of sensitivity information among the formulations under study is straightforward. This enables not only experimentation with a variety of problem formations in a research environment, but also the flexible use of formulations in a production design environment.
Author
Multidisciplinary Design Optimization; Autonomy; Algorithms

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030062021 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Agent Inspired Reconfigurable Computing Implementation of a Genetic Algorithm
Weir, John M.; Wells, B. Earl; April 1, 2003; 8 pp.; In English; 2003 International Conference on Parallel and Distributed Processing Techniques and Applications, 23-26 Jun. 2003, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

Many software systems have been successfully implemented using an agent paradigm which employs a number of independent entities that communicate with one another to achieve a common goal. The distributed nature of such a paradigm makes it an excellent candidate for use in high speed reconfigurable computing hardware environments such as those present in modem FPGA's. In this paper, a distributed genetic algorithm that can be applied to the agent based reconfigurable hardware model is introduced. The effectiveness of this new algorithm is evaluated by comparing the quality of the solutions found by the new algorithm with those found by traditional genetic algorithms. The performance of a reconfigurable hardware implementation of the new algorithm on an FPGA is compared to traditional single processor implementations.
Author
Software Engineering; Genetic Algorithms; Reconfigurable Hardware; Field-Programmable Gate Arrays

20030062023 Computer Sciences Corp., Huntsville, AL, USA
Simulation of Wind Profile Perturbations for Launch Vehicle Ascent Flight Systems Design Assessments
Adelfang, S. I.; January 06, 2003; 1 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: Other Sources; Abstract Only

Ideally, a statistically representative sample of measured high-resolution wind profiles with wavelengths as small as tens of meters is required for assessment of launch vehicle ascent flight systems component capability and vehicle operability for a selected launch site. At most potential launch sites a sample of high-resolution measured wind profiles may not exist. Representative samples of Rawinsonde wind profiles are more likely to be available because of the extensive network of measurement sites established for routine measurements at 12-hr intervals in support of national and international weather observing and forecasting activity. Such a sample, although large enough to statistically represent relatively large wavelength perturbations, would be inadequate for launch system design assessment applications because the Rawinsonde system can accurately measure wind perturbations with wavelengths no smaller than 2000m (1000m altitude increment). Wavelengths less than 2000m in the raw Rawinsonde data, which tend to be dominated by un-damped spurious balloon motion and radar tracking system noise, are filtered within the data processing scheme. The Kennedy Space Center (KSC) Jimsphere wind profiles (150/month and seasonal pairs) are the only adequate high resolution (approximately 150 to 300m effective resolution, but over-sampled at 25m intervals) data that have been used extensively in launch vehicle design, operability assessments and operational protection of vehicle systems for wind perturbation uncertainty. Jimsphere wind profiles have been measured at a few other potential launch sites but the number of profiles is relatively small and the samples are not statistically representative of the site dependent wind profile variability. A simulation process has been developed for enhancement of measured low-resolution Rawinsonde profiles that are more likely to be available in the vicinity of potential launch sites and are a statistically representative sample of wind profile perturbation wavelengths greater than 2000m. The enhancement

produces perturbed wind profiles with wavelengths as small as desired for application in launch vehicle ascent flight simulations and design assessments.
Author
Wind Profiles; Computerized Simulation; Launch Vehicles; Ascent Propulsion Systems; Reliability Analysis; Design Analysis; Spacecraft Components

20030062053 Cornell Univ., Ithaca, NY
An Open Logical Programming Environment. A Practical Framework for Sharing Formal Models
Constable, Robert L.; Kreitz, Christoph; Dec. 2002; 10 pp.; In English
Contract(s)/Grant(s): F30602-98-2-0198; Proj-G356
Report No.(s): AD-A411860; AFRL-IF-WP-TM-2003-1501; No Copyright; Avail: CASI; A02, Hardcopy

The project has designed, built and tested a prototype system called a Logical Programming Environment (LPE), which provides the means to formally specify, design, verify, and optimize distributed embedded systems. The LPE has been used in increasingly complex applications, ranging from automatic code improvements for the Ensemble group communication system to the formal design of adaptive network systems and the automatic generation of coordinated contracts for BBN's Unmanned Aerial Vehicle (UAV) application. In each case, using the LPE has led to significantly increased assurance, flexibility, or efficiency of the application. In the process, substantial extensions to the LPE's logical foundations and its automated reasoning capabilities were made, thus increasing its ability to contribute to the design and implementation of reliable, reusable, reconfigurable, correct, and efficient distributed embedded systems.
DTIC
Software Engineering; Computer Programming

20030062142 NASA Marshall Space Flight Center, Huntsville, AL, USA
Telescience Resource Kit
Schneider, Michelle; [2003]; 8 pp.; In English; Ground Systems Architectures Workshops, 4-6 Mar. 2003, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

This viewgraph representation provides an overview of the Telescience Resource Kit. The Telescience Resource Kit is a pc-based telemetry and command system that will be used by scientists and engineers to monitor and control experiments located on-board the International Space Station (ISS). Topics covered include: ISS Payload Telemetry and Command Flow, kit computer applications, kit telemetry capabilities, command capabilities, and training/testing capabilities.
Author
Communication Networks; Remote Control; Spaceborne Experiments; Telemetry; Computer Programming; Signal Processing; Applications Programs (Computers)

20030062144 University of Southern California, Marina del Rey, CA
Tools for Assembling and Managing Scalable Knowledge Bases
Chalupsky, Hans; Feb. 2003; 85 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0194; Proj-IIST
Report No.(s): AD-A412034; AFRL-IF-RS-TR-2003-29; No Copyright; Avail: CASI; A05, Hardcopy

The DARPA High Performance Knowledge Base (HPKB) program was aimed to produce technology to rapidly construct large, reusable, and maintainable ontologies and knowledge bases (KBs). To achieve this goal, large-scale KBs cannot always be built from scratch, but instead need to be assembled as much as possible from existing resources. Reuse, however, does not come for free: reusable material has to be identified, translated, adapted, debugged, merged with other material and maintained, all of which can be very difficult and expensive processes. Therefore, for reuse to be effective, it has to be supported by a set of adequate knowledge base construction, editing and maintenance tools. This report describes an HPKB effort that built a variety of tools and infrastructure aimed at supporting the ontology and knowledge base construction process. All these tools are centered around the PowerLoom Knowledge Representation and Reasoning (KR&R) system (http: //www.isi.edu/isd/ LOOM/PowerLoom), which is a highly expressive, logic-based KR&R system with multiple built-in deductive reasoning capabilities including a query processor, a description classifier, and a context mechanism. The developed tools cover various areas of the knowledge base and ontology construction process and are outlined in the report.
DTIC
Knowledge Based Systems; Data Management

20030062191 NASA Marshall Space Flight Center, Huntsville, AL, USA

A Three-Dimensional Heat Transfer Model of a Thermoset Fiber Placement Composite Manufacturing Process

Hassan, Noha; Song, Xiaolan; Thompson, Joseph E.; Loos, Alfred C.; Batra, Romesh C.; Hulcher, A. Bruce; [2003]; 16 pp.; In English; SAMPE International Symposium and Exhibition, 12-16 May 2003, Long Beach, CA, USA

Contract(s)/Grant(s): 02-0798-10; Copyright; Avail: Other Sources

A computer code has been developed to accurately simulate the three-dimensional heat transfer during the continuous placement of a towpreg for the economical manufacture high quality composites. The code is based on the Lagrangian formulation of the problem. It employs eight-node brick elements, and the 2x2x2 integration rule to numerically evaluate integrals over an element. The coupled ordinary differential equations obtained by the semi-discrete formulation of the problem are integrated by the unconditionally stable backward-difference method. The code has been validated by comparing computed results for several problems with those available in the literature. The computed temperature distribution in the continuous laying of a tape over a cylindrical mandrel is found to compare very well with the test findings. The code can be used to find the optimum processing variables.

Author

Heat Transfer; Three Dimensional Models; Computerized Simulation; Manufacturing; Fiber Composites; Fiber Orientation; Finite Element Method

20030062193 Lockheed Martin Space Operations, Huntsville, AL, USA

Case for Deploying Complex Systems Utilizing Commodity Components

Bryant, Barry S.; Pitts, R. Lee; [2003]; 3 pp.; In English; Ground Systems Architectures Workshop 2003, 4-6 Mar. 2003, Manhattan Beach, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

When the International Space Station (ISS) finally reached an operational state, many of the Payload Operations and Integration Facility (POIF) hardware components were reaching end of life, COTS product costs were soaring, and the ISS budget was becoming severely constrained. However, most requirement development was complete. In addition, the ISS program is a fully functioning program with at least fifteen years of operational life remaining. Therefore it is critical that any upgrades, refurbishments, or enhancements be accomplished in realtime with minimal disruptions to service. For these and other reasons, it was necessary to ensure the viability of the POIF. Due to the to the breadth of capability of the POIF (a NASA ground station), it is believed that the lessons to be learned by other complex systems are applicable and any solutions garnered by the POIF are applicable to other complex systems as well. With that in mind, a number of new approaches have been investigated to increase the portability of the POIF and reduce the cost of refurbishment, operations, and maintenance. These new approaches were directed at the Total Cost of Ownership (TCO); not only the refurbishment but also current operational difficulties, licensing, and anticipation of the next refurbishment. Our basic premise is that technology had evolved dramatically since the concept of the POIF ground system and we should leverage our experience on this new technological landscape. Fortunately, Moore's law and market forces have changed the landscape considerably. These changes are manifest in five (5) ways that are particularly relevant to POIF: 1. Complex Instruction Set Computing (CISC) processors have advanced to unprecedented levels of compute capacity with a dramatic cost break, 2. Linux has become a major operating system supported by most vendors on a broad range of platforms, 3. Windows(TradeMark) based desktops are pervasive in the office environment, 4. Stable and affordable WindowsTM development environments and tools are available and offer a rich set of capabilities, 5. The WindowsTM 2000 provides a stable client platform, Therefore, five studies were proposed, developed, and are in the current process of deployment which dramatically reduces the cost of operations, maintenance, refurbishment, and deployment of a ground system. Restating and refining the basic premise stated earlier, it is possible to enhance operations through the replacement of hardware and software components with commodity based items wherever applicable. This will dramatically reduce the overall lifecycle cost of the project. The first study leveraged the POIF S secure, three-tier, web architecture to replace the client workstations with lower cost PC platforms. A second study initiated a review of COTS products to examine the level of added value of each product. This study included replacement of some COTS products with custom code, deletions, substitutions, and consolidation of COTS products. Studies three and four reviewed the server architectures of the data distribution systems and Enhanced HOSC System (EHS) command and telemetry system to propose migration to new platforms, both software and hardware. The final study reviewed current IP communication technologies, developed an operational model for flight operations, and demonstrated that voice over IP was practical and could be integrated into operations.

Author

Complex Systems; Computer Programs; Cost Reduction; Real Time Operation; Payload Integration; Operating Costs; Data Systems

20030062202 Washington Univ., Saint Louis, MO, USA

Applying Reflective Middleware Techniques to Optimize a QoS-enabled CORBA Component Model Implementation

Wang, Nanbor; Parameswaran, Kirthika; Kircher, Michael; Schmidt, Douglas; [2003]; 8 pp.; In English; 24th IEEE Computer Software and Applications Conference, 25-28 Oct. 2000, Taipei, Taiwan, Province of China

Contract(s)/Grant(s): NCC3-777; Copyright; Avail: CASI; A02, Hardcopy

Although existing CORBA specifications, such as Real-time CORBA and CORBA Messaging, address many end-to-end quality-of service (QoS) properties, they do not define strategies for configuring these properties into applications flexibly, transparently, and adaptively. Therefore, application developers must make these configuration decisions manually and explicitly, which is tedious, error-prone, and open sub-optimal. Although the recently adopted CORBA Component Model (CCM) does define a standard configuration framework for packaging and deploying software components, conventional CCM implementations focus on functionality rather than adaptive quality-of-service, which makes them unsuitable for next-generation applications with demanding QoS requirements. This paper presents three contributions to the study of middleware for QoS-enabled component-based applications. It outlines rejective middleware techniques designed to adaptively (1) select optimal communication mechanisms, (2) manage QoS properties of CORBA components in their containers, and (3) (re)con$gure selected component executors dynamically. Based on our ongoing research on CORBA and the CCM, we believe the application of rejective techniques to component middleware will provide a dynamically adaptive and (re)configurable framework for COTS software that is well-suited for the QoS demands of next-generation applications.

Author

Programming Languages; Computer Programs; Distributed Processing; Computer Networks; Architecture (Computers); Systems Integration; Interoperability

20030062205 Dundee Univ., UK

A Finite-Element Model for Evaluation of Middle Ear Mechanics

Abel, E. W.; Lord, R. M.; 25 Oct. 2001; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411779; No Copyright; Avail: CASI; A01, Hardcopy

A computer model of the middle ear, ossicular chain and eardrum was established using the finite-element method. A preliminary comparison of the model with measurements made in human-cadaver ears shows that the model is in approximate agreement with the form of the middle ear function. The computer model will be used for implant design.

DTIC

Computerized Simulation; Middle Ear

20030062211 Florida International Univ., Miami, FL

Application of the Walsh Transform in an Integrated Algorithm for the Detection of Interictal Spikes

Sanchez, D.; Adjouadi, M.; Barreto, A.; Jayakar, P.; Yaylali, I.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411824; No Copyright; Avail: CASI; A01, Hardcopy

This paper introduces a novel spike detection algorithm based on the use of Walsh Transforms. The algorithm focuses on the assessment of characteristics in the Electroencephalogram (EEG) signal that reveal the presence of a spike feature. The mathematical formulation of the algorithm is introduced and results obtained from the analysis of data from 7 epileptic patients are presented.

DTIC

Algorithms; Electroencephalography; Spikes

20030062245 NASA Marshall Space Flight Center, Huntsville, AL, USA

Mathematical Inversion of Lightning Data: Techniques and Applications

Koshak, William; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A survey of some interesting mathematical inversion studies dealing with radio, optical, and electrostatic measurements of lightning are presented. A discussion of why NASA is interested in lightning, what specific physical properties of lightning are retrieved, and what mathematical techniques are used to perform the retrievals are discussed. In particular, a relatively new multi-station VHF time-of-arrival (TOA) antenna network is now on-line in Northern Alabama and will be discussed. The network, called the Lightning Mapping Array (LMA), employs GPS timing and detects VHF radiation from discrete segments (effectively point emitters) that comprise the channel of lightning strokes within cloud and ground flashes. The LMA supports on-going ground-validation activities of the low Earth orbiting Lightning Imaging Sensor (LIS) satellite developed at NASA

Marshall Space Flight Center (MSFC) in Huntsville, Alabama. The LMA also provides detailed studies of the distribution and evolution of thunderstorms and lightning in the Tennessee Valley, and offers interesting comparisons with other meteorological/geophysical datasets. In order to take full advantage of these benefits, it is essential that the LMA channel mapping accuracy (in both space and time) be fully characterized and optimized. A new channel mapping retrieval algorithm is introduced for this purpose. To characterize the spatial distribution of retrieval errors, the algorithm has been applied to analyze literally tens of millions of computer-simulated lightning VHF point sources that have been placed at various ranges, azimuths, and altitudes relative to the LMA network. Statistical results are conveniently summarized in high-resolution, color-coded, error maps.
Author
Numerical Analysis; Lightning; Electrostatics; Physical Properties; Optical Measurement; Algorithms

20030062295 Carnegie-Mellon Univ., Pittsburgh, PA
Rendering Tcl/Tk Windows as HTML
Hansen, William J.; Feb. 2003; 22 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A412017; CMU/SEI-2003-TN-002; No Copyright; Avail: CASI; A03, Hardcopy

Tool Control Language (Tcl) is a programming language having a Toolkit (Tk) library that provides a standard set of graphical user interface (GUI) widgets. Since these are aimed at direct presentation via a window manager, Tcl/Tk applications are not compatible with Web-based service delivery environments. Several tools provide some help, but do not provide a migration path for eventual full conversion to Web-based delivery. This note suggests a new approach. For the particular application prompting this note, the GUI consists almost entirely of Tk widgets, especially tables and buttons. Hypertext Markup Language (HTML) offers these same widgets, so it is natural to consider delivering Tk windows by expressing their contents in HTML. To demonstrate this possibility, the Tk library was altered to generate HTML. As described in the paper, this shows that the Tcl/Tk internal data structures are sufficient to generate appropriate HTML commands having the same user interface as that presented by the application. Consequently, it is possible to add to Tk a fourth GUI interface in parallel to the existing ones for Unix, Macintosh, and MS windows.
DTIC
Programming Languages; Graphical User Interface

20030062302 Carnegie-Mellon Univ., Pittsburgh, PA
Applying FSQ Engineering Foundations to Automated Calculation of Program Behavior
Linger, Richard C.; Feb. 2003; 37 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A412025; CMU/SEI-2003-TN-003; No Copyright; Avail: CASI; A03, Hardcopy

No software engineer can say with assurance how a sizable program, with its virtually infinite number of possible execution paths, will behave, that is, what it will do, in all circumstances of use. This incredible reality, widely acknowledged but little discussed, lies at the heart of intractable problems experienced in software development and use over the past 40 years. If full behavior is unknown, so too are embedded errors, vulnerabilities, and malicious code that can emerge in use. While this reality has seemed inevitable in the past, it need not be so in the future. The SEI CERT Coordination Center has been conducting research on Flow-Service-Quality (FSQ) engineering for complex, network-centric system analysis and development. FSQ Flow Structures treat the control structures of programs as rules, or implementations, of mathematical functions, that is; mappings from domains to ranges. The function, or behavior, of any control structure can be abstracted into a procedure-free statement that specifies its net functional effect in all circumstances of use with mathematical precision. The finite number of control structures in a program can be abstracted in stepwise fashion in an algebra of functions, to arrive at a precise statement of the program's overall behavior. The mathematical foundations largely exist, and development of such a capability is feasible, albeit difficult. Automated program behavior calculation would have a dramatic effect on software and systems engineering, and enable a new level of assurance in trustworthy systems. This report briefly summarizes research to date on Flow Structures and describes the application of their function-theoretic mathematical foundations to the problem of program behavior calculation.
DTIC
Complex Systems; Error Anaylsis; Control Systems Design; Software Engineering

20030062760 NASA Ames Research Center, Moffett Field, CA, USA

A Domain Description Language for Data Processing

Golden, Keith; [2003]; 10 pp.; In English; ICAPS Workshop on Future of PDDL, 9 Jun. 2003, Trento, Italy; No Copyright; Avail: CASI; A02, Hardcopy

We discuss an application of planning to data processing, a planning problem which poses unique challenges for domain description languages. We discuss these challenges and why the current PDDL standard does not meet them. We discuss DPADL (Data Processing Action Description Language), a language for describing planning domains that involve data processing. DPADL is a declarative, object-oriented language that supports constraints and embedded Java code, object creation and copying, explicit inputs and outputs for actions, and metadata descriptions of existing and desired data. DPADL is supported by the IMAGEbot system, which we are using to provide automation for an ecological forecasting application. We compare DPADL to PDDL and discuss changes that could be made to PDDL to make it more suitable for representing planning domains that involve data processing actions.

Author

Data Processing; Object-Oriented Programming; Computer Programs; Data Management; Domains

20030062766 NASA Ames Research Center, Moffett Field, CA, USA

Hybrid Concurrent Constraint Simulation Models of Several Systems

Sweet, Adam; [2003]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

This distribution contains several simulation models created for the hybrid simulation language, Hybrid Concurrent Constraint (HCC). An HCC model contains the information specified in the widely-accepted academic definition of a hybrid system: this includes expressions for the modes of the systems to be simulated and the differential equations that apply in each mode. These expressions are written in the HCC syntax. The models included here were created by either applying basic physical laws or implementing equations listed in previously published papers.

Derived from text

Computerized Simulation; Mathematical Models; Coding; Computer Programs

20030062770 Shanghai Jiao Tong Univ., China

A Novel Volume CT With X-Ray on a Trough-Like Surface and Point Detectors on Circle-Plus-Arc Curve

Xu, H.; Zhuang, T. G.; 25 Oct. 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A412227; No Copyright; Avail: CASI; A01, Hardcopy

A novel imaging mode of cone-beam volume CT is proposed in this paper. It adopts a raster scanning x-ray source on a trough-like surface, and a group of point detectors distributing on a large circle plus an orthogonal arc. Through a single rotation of the trough-like surface, a full set of projection data can be acquired and an accurate 3D image can be reconstructed. This paper describes the shape and dimension of the trough-like x-ray source and the configuration of detectors in detail, proves that this structure is satisfied with the completeness condition, and gives a reconstruction algorithm of 3-D image adapting to this structure. Computer simulations show that this structure could achieve optimal result in meeting the following requirements: minimum time of rotation, less Compton scatter, and fast image reconstruction speed while keeping the completeness condition to be realized.

DTIC

Computerized Simulation; Detectors; X Rays; Image Reconstruction

20030062775 University of Southern California, Los Angeles, CA, USA

An Integrated Package of Neuromusculoskeletal Modeling Tools in Simulink (TM)

Davoodi, R.; Brown, I. E.; Lan, N.; Mileusnic, M.; Loeb, G. E.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A412056; No Copyright; Avail: CASI; A01, Hardcopy

An integrated neuromusculoskeletal (NMS) modeling tool has been developed to facilitate the study of the control of movement in humans and animals. Blocks representing the skeletal linkage, sensors, muscles, and neural controllers are developed using separate software tools and integrated in the powerful simulation environment of Simulink (Mathworks Inc., USA). Musculoskeletal Modeling in Simulink (MMS) converts anatomically accurate musculoskeletal models generated by SIMM (Musculographics Inc., USA) into Simulink blocks. It also removes runtime constraints in SIMM, and allows the development of complex musculoskeletal models without writing a line of code, Virtual Muscle builds realistic Simulink models of muscle force production under physiologic and pathologic conditions, A generic muscle spindle model has also been

developed to simulate the sensory output of the primary and secondary afferents, Neural control models developed by various Matlab (Mathworks Inc,, USA) toolboxes can be integrated easily with these model components to build complete NMS models in an integrated environment.
DTIC
Musculoskeletal System; Systems Integration; Mathematical Models; Computerized Simulation; Neuromuscular Transmission; Software Development Tools

20030062778 New Univ. of Ulster, UK
Automated Synthesis of Prediction Models for Neural Network Based Myocardial Infarction Classifiers
Lopez, J. A.; Nugent, C. D.; Black, N. D.; Smith, A. E.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations Report No.(s): AD-A412208; No Copyright; Avail: CASI; A01, Hardcopy

Parameter and architectural selection for Multiple Layered Perceptron (MLP) classifiers involve a number of heuristic design procedures, The mm in the design process of such classifiers is to achieve maximum generalization and avoid over-fitting of the training data. It has been the objective of this study to develop a symbolic prediction model to calculate the point at which training should cease for a given Neural Network (NN) based 12-lead ECG classifier to ensure maximum generalization. This prediction model has been obtained by means of Genetic Programming (GP), where a GP individual has been evolved to generate a symbolic model that predicts the optimal number of training epochs for three different ECG myocardial infarction classifiers: Anterior Myocardial Infarction (AMI), Inferior Myocardial Infarction (IMI), and Combined Myocardial Infarction (CMI). The GP model demonstrated to be a very accurate method showing no significant differences between the optimal number of epoch values and the predicted values for both: train and test data sets for the three aforementioned pathologies.
DTIC
Neural Nets; Computer Programming; Myocardial Infarction

20030062820 Illinois Inst. of Tech., Chicago, IL, USA
The Electronic Nose Training Automation Development
Schattke, Nathan; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 149-156; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The electronic nose is a method of using several sensors in conjunction to identify an unknown gas. Statistical analysis has shown that a large number of training exposures need to be performed in order to get a model that can be depended on. The number of training exposures needed is on the order of 1000. Data acquisition from the noses are generally automatic and built in. The gas generation equipment consists of a Miller-Nelson (MN) flow/temperature/humidity controller and a Kin-Tek (KT) trace gas generator. This equipment has been controlled in the past by an old data acquisition and control system. The new system will use new control boards and an easy graphical user interface. The programming for this is in the LabVIEW G programming language. A language easy for the user to make modifications to. This paper details some of the issues in selecting the components and programming the connections. It is not a primer on LabVIEW programming, a separate CD is being delivered with website files to teach that.
Author
Automation; Computer Systems Programs; Computer Components; Neural Nets; Chips (Electronics)

20030062822 Miles Coll., Birmingham, AL, USA
Program and Project Management Framework
Butler, Cassandra D.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 29-38; In English; See also 20030062814; No Copyright; Avail: CASI; A02, Hardcopy

The primary objective of this project was to develop a framework and system architecture for integrating program and project management tools that may be applied consistently throughout Kennedy Space Center (KSC) to optimize planning, cost estimating, risk management, and project control. Project management methodology used in building interactive systems to accommodate the needs of the project managers is applied as a key component in assessing the usefulness and applicability of the framework and tools developed. Research for the project included investigation and analysis of industrial practices, KSC standards, policies, and techniques, Systems Management Office (SMO) personnel, and other documented experiences of project management experts. In addition, this project documents best practices derived from the literature as well as new or developing project management models, practices, and techniques.
Author
Architecture (Computers); Management Methods; Project Management

20030062880 University of North Texas, Denton, TX, USA

Computer Graphics Software For Teaching Crystallography

Simoes, Ricardo; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 203-211; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Continuous advances in computer hardware as well as graphical programming interfaces have made possible the development of graphical software tools for educational purposes. One of the many possible applications of using three-dimensional modeling and rendering software in teaching crystallography. While it is sometimes confusing to learn the various structures of crystals from two-dimensional static pictures, this task becomes much easier when one can visualize, move, rotate and apply a variety of effects to a structure in three-dimensions. Inexpensive software such as Matvis and the world-wide availability of computers allow students to have this software installed in their own computers or available in computer rooms at their university. In this way in-class learning can be complemented outside the classroom at a time convenient for the student. Educational software that students can run on their own can also be used in distance learning courses.

Author

Computer Graphics; Crystallography; Software Engineering; Materials Science; Computer Programming; Education

20030062913 Carnegie-Mellon Univ., Pittsburgh, PA

SARMAPPER: A Real-Time Interactive SAR Tactical Mapper

Hampshire, John B., II; May 1997; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-97-1-1017; Proj-ARPA

Report No.(s): AD-A412009; AFRL-SN-WP-TR-2003-100; No Copyright; Avail: CASI; A03, Hardcopy

SARMapper is near-real-time, interactive software for generating high-accuracy tactical ground cover maps from synthetic aperture radar (SAR) imagery using current-technology laptop computers. Such maps make it possible to automate the focus-of-attention mechanism that is the foundation of tactical image analysis, target detection, and target recognition. This document describes a proof-of-concept first instantiation of sarMapper and outlines further technical issues to be addressed in the 1997 sarMapper research effort.

DTIC

Computer Programs; Image Processing; Synthetic Aperture Radar; Mapping; Image Analysis; Radar Imagery

20030062924 University of Central Florida, Orlando, FL

OPCODE (Orlando Parallel Computation Development Environment)

Schiavone, Guy; Mar. 2002; 32 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0195

Report No.(s): AD-A411906; AFRL-SR-AR-TR-02-0450; No Copyright; Avail: CASI; A03, Hardcopy

The OPCODE project has resulted in purchase of components for the construction of two 192-processor computing clusters, one located at 1ST (OPCODE I) and the other at SEECS UCF (OPCODE II). OPCODE I, shown in Figure 1, is completed and has been benchmarked using SCALAPACK at 86.5 GFLOPS using 144 nodes of the total 192 compute nodes (See Appendix B for results). The OPCODE II cluster is currently under construction, and is about half complete. These clusters employ a fast Ethernet network, linked together over a high-speed, fully stacked switch.

DTIC

Architecture (Computers); Parallel Processing (Computers)

20030062926 BBN TECHNOLOGIES ARLINGTON VA, Arlington, VA, USA

Development of an Infrasound Propagation Modeling Tool Kit

Gibson, Robert; Norris, David; Oct. 2002; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DSWA01-97-C-0160

Report No.(s): AD-A411914; W1355; DTRA/FB-TR-99-47; No Copyright; Avail: CASI; A04, Hardcopy

A software tool kit that integrates infrasound propagation models and upper atmospheric characterizations has been developed. The acoustic propagation models consist of a three dimensional ray theory model, a normal mode model, and a continuous-wave, two dimensional parabolic equation model. The baseline empirical atmospheric models are the Horizontal Wind Model and the Extended Mass Spectrometer - Incoherent Scatter Radar temperature model. Wind, temperature, and densities are modeled from the surface into the thermosphere and include spatial, diurnal, and seasonal effects. The component

models have been integrated to allow for user friendly model execution and data visualization. Models can be applied to predict propagation characteristics necessary for estimation of travel times, bearings, and amplitudes from potential event locations worldwide. The software has been developed for modeling localization performance of a network of infrasound sensors. Studies are presented that analyze sensitivity of propagation predictions to environmental parameters. Comparisons of model predictions to measured events of interest are discussed.
DTIC
Computerized Simulation; Kits; Tools; Software Development Tools; Sound Propagation

20030062931 Defence Science and Technology Organisation, Salisbury, Australia
A DIS Entity State PDU Generator
Zalcman, Lucien; Oct. 2002; 27 pp.; In English
Report No.(s): AD-A411953; DSTO-TN-0460; DODA-AR-012-495; No Copyright; Avail: CASI; A03, Hardcopy

The recent I/ITSEC 2001 Coalition Training Demonstration held between the US, Australian and Dutch Navies demonstrated a coalition training exercise using Advanced Distributed Simulation to simultaneously connect military training simulators in the USA, Australia and the Netherlands. Whilst participating in the setup and running of this exercise each nation used whatever tools were available to establish and maintain connectivity and interoperability. As one of the lessons learned from such a coalition exercise, this paper discusses a proposal to make available to all participating coalition nations a Common Coalition Toolset (CCT) which comprises a set of software applications used to establish and maintain connectivity and interoperability for such coalition training demonstrations and/or exercises. This paper describes a candidate CCT application - a DIS Entity State PDU Generator. This application was found to be extremely useful when setting up a multiplayer Advanced Distributed Simulation such as the recent I/ITSEC 2001 Coalition Training Demonstration.
DTIC
Computer Programs; Military Operations; Architecture (Computers)

20030062948 Loma Linda Univ., CA, USA
Presenting Systems Concepts in Physiology and Pharmacology With Simulation Applets in JAVA
Kootsey, J. M.; McAuley, Grant; Liu, Hua; Oct. 25, 2001; 5 pp.; In English
Report No.(s): AD-A411497; No Copyright; Avail: CASI; A01, Hardcopy

Java simulation applets solving equations for system models have been constructed for teaching system behavior in Pharmacology and Physiology. The applets are intended to be included in Web pages with text and other illustrations for use in the classroom or in self-study lessons. Students can experiment with the system by changing selected model parameters with sliders, immediately observing the resulting changes in system behavior. Several applet presentations are constructed for a model, each presentation designed for a different learning objective by displaying a subset of output variables and making a subset of parameters available for adjustment. Presentations may include control buttons, a graph for output display, sliders to adjust parameters, a legend table comparing parameter settings for multiple experiments, and an animation of the model linked to the calculations. The applet design is highly modular to facilitate replication with different models. Two architectures were tested and compared: 1) a single applet containing all the functions listed above embedded as a single unit in the Web page and 2) a cluster of individual applets of different functional types (control buttons, graph, sliders, etc,) distributed over the Web page and linked by a control object having no visible interface.
DTIC
Applications Programs (Computers); Java (Programming Language); Simulation

20030062952 Space and Naval Warfare Systems Command, San Diego, CA, USA
Infrared Search and Track Installation Instructions and User's Guide. DoD HPC Modernization Program (CHSSI SIP-8)
Douma, John W.; Cottel, Dennis; Dec. 2002; 25 pp.; In English
Contract(s)/Grant(s): Proj-SIP8
Report No.(s): AD-A411507; SSC/SD-TD 3148; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of the Common High Performance Computing Software Support Initiative (CHSSI) Infrared Search and Track for Missile Surveillance (IRST) SIP-8 project is to provide a scalable, high performance capability for developing infrared surveillance algorithms. The basis for this effort is the Distributed Algorithm Stream (DAS) software package previously developed by the Airborne Infrared Measurement Systems (AIRMS) program, funded by the Defense Advanced Research Projects Agency (DARPA) Sensor Technology Office (STO) from 1989 through 1996. The AIRMS program

demonstrated the longwave infrared (LWIR) sensor and signal processing technology necessary to detect dim targets at ranges of up to 300 nautical miles against cluttered backgrounds.
DTIC
Manuals; Installing; Military Technology; Infrared Imagery; Surveillance

20030062964 Thiokol Propulsion, Brigham City, UT, USA
An Automated Fluid-Structural Interaction Analysis of a Large Segmented Solid Rocket Motor
Rex, Brian W.; Wang, Qunzhen; Isaac, Daron; Feb. 10, 2003; 3 pp.; In English
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A412160; AFRL-PR-ED-AB-2003-034; No Copyright; Avail: CASI; A01, Hardcopy

A new analysis procedure has been used to evaluate the propellant grain/flow stability of a new, five-segment Space Shuttle solid rocket booster. The fluid-structural interaction (FSI) analysis of the ETM-3 motor used PYTHON, a powerful programming language, and FEM BUILDER, a pre- and post processor developed by ATK Thiokol Propulsion under contract to the AFRL, to automatically couple the ABAQUS structural solver with FLUENT, the computational fluid dynamics (CFD) solver. This iterative process automatically used the results of one solver as the inputs to the other solver until convergence to a solution was obtained. The ETM-3 motor was basically an reusable solid rocket motor (RSRM) with an additional center segment added. The additional segment and greater nozzle diameter increased mass flow and mach number in the motor. Because of this harsher flow environment, it was necessary to conduct a detailed FSI analysis to ensure propellant grain stability against boot-strapping. This paper details the FSI analysis work done for ETM-3. The analyses conducted and documented in this report assumed linear elastic material behavior and steady state fluid behavior without time response in either the structural or fluid models.
DTIC
Computer Programs; Stability; Computational Fluid Dynamics; Solid Propellant Rocket Engines; Fluid Flow; Propellant Grains

20030062968 University of Technology, Sydney, Australia
Detection of Stellates and Masses in Digitized Mammograms
Nguyen, H. T.; Hung, W. T.; Thornton, B. S.; Lee, W.; Rickard, M.; 25 Oct. 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411915; No Copyright; Avail: CASI; A01, Hardcopy

If detected early, breast cancer can be treated with better patient outcomes and significantly lower costs. From recent (1998) retrospective breast cancer studies, in approximately half of missed cases, a minimal sign was already visible on a prior mammogram. Using information technology such as spatial dendrograms (stealth-related technology) and repartment hierarchical identification (successive information peeling), difficult cases of spiculated and a stellate tumors can be identified. The techniques are robust to noise and can reveal various layers of biophysical and biomedical differences in a tumor.
DTIC
Detection; Cancer; Mammary Glands; Computer Aided Tomography

20030062982 Universidad Politecnica de Valencia, Valencia, Spain
MedMap: A Powerful Multichannel ELG Recordings Analyzer
Martinez, A.; Millet, J.; Chorro, J.; Cebrian, A.; Arredondo, M. T.; Garcia, I.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411471; No Copyright; Avail: CASI; A01, Hardcopy

Study and analysis of multiple recording electrograms in experimental models requires dedicated software for their processing. This software must be quick and efficient in manipulating the enormous amounts of recorded data. Furthermore, the software has to be easily extensible in order to introduce new work methods and analysis algorithms adapted to the needs of each research group. This has led us to develop a modular software package in which introduction of new functionalities will not require the development of a new program, resulting in considerable time savings. For development we chose MATLAB, an interactive program with high computing capabilities and powerful tools for graphic visualization. Being a standard platform, developed code can be easily modified and the functionality of any module can be optimized and/or altered at any time, allowing implementation of the latest scientific advances. This software has been conceived for many applications,

although in this paper we focus our experience on the study of fibrillatory processes in experimental models where up to 256 electrograms have been recorded using a cardiac electrical system.
DTIC
Data Processing; Software Development Tools

20030063022 Computer Sciences Corp., Moffett Field, CA, USA
Improving Resource Selection and Scheduling Using Predictions, Chapter 1
Smith, Warren; [2003]; 22 pp.; In English
Contract(s)/Grant(s): RTOP 725-10-31; No Copyright; Avail: CASI; A03, Hardcopy

The introduction of computational grids has resulted in several new problems in the area of scheduling that can be addressed using predictions. The first problem is selecting where to run an application on the many resources available in a grid. Our approach to help address this problem is to provide predictions of when an application would start to execute if submitted to specific scheduled computer systems. The second problem is gaining simultaneous access to multiple computer systems so that distributed applications can be executed. We help address this problem by investigating how to support advance reservations in local scheduling systems. Our approaches to both of these problems are based on predictions for the execution time of applications on space- shared parallel computers. As a side effect of this work, we also discuss how predictions of application run times can be used to improve scheduling performance.
Author
Computational Grids; Scheduling; Time Functions

20030063026 Army Aviation Systems Command, Moffett Field, CA, USA
A Comparative Study of Three Methodologies for Modeling Dynamic Stall
Sankar, L.; Rhee, M.; Tung, C.; ZibiBailly, J.; LeBalleur, J. C.; Blaise, D.; Rouzaud, O.; [2002]; 4 pp.; In English; European Rotocraft Forum, 17-20 Sep. 2002, UK; Copyright; Avail: CASI; A01, Hardcopy

During the past two decades, there has been an increased reliance on the use of computational fluid dynamics methods for modeling rotors in high speed forward flight. Computational methods are being developed for modeling the shock induced loads on the advancing side, first-principles based modeling of the trailing wake evolution, and for retreating blade stall. The retreating blade dynamic stall problem has received particular attention, because the large variations in lift and pitching moments encountered in dynamic stall can lead to blade vibrations and pitch link fatigue. Restricting to aerodynamics, the numerical prediction of dynamic stall is still a complex and challenging CFD problem, that, even in two dimensions at low speed, gathers the major difficulties of aerodynamics, such as the grid resolution requirements for the viscous phenomena at leading-edge bubbles or in mixing-layers, the bias of the numerical viscosity, and the major difficulties of the physical modeling, such as the turbulence models, the transition models, whose both determinant influences, already present in static maximal-lift or stall computations, are emphasized by the dynamic aspect of the phenomena.
Derived from text
Computational Fluid Dynamics; Rotors; Mathematical Models; High Speed; Shock Loads; Turbulence Models; Aerodynamic Stalling

20030063041 NASA Marshall Space Flight Center, Huntsville, AL, USA
Application of the Loci-Based CFD Code Chem at MSFC: Preliminary Results
West, Jeff S.; Rothermel, Jeff; [2002]; 36 pp.; In English; MSFC Fall Fluids Workshop, 19-21 Nov. 2002, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. Objectives. Concentrate on determining the qualitative accuracy, performance and robustness of the Chen code. 2. What is the Loci-Chem CFD code? Density-based, finite volume, generalized unstructured grid, Navier-Stokes solver. The algorithm was implemented using the Loci framework, which allows implementation issues such as parallel processing to be handled transparently to the coding of the CFD algorithm. 3. Application to Bifurcating Duct problem. Flow splits from single duct to two ducts. 4. Application to single element injector. 5. Application to PSU RBCC rig. 6. 90 degree elbow benchmark problem. 7. Future work.
CASI
Computational Fluid Dynamics; Finite Volume Method; Computer Programs; Loci; Navier-Stokes Equation; Ducts

20030063112 Boeing Phantom Works, USA
High Power Electric Systems for Fast Outer Planet Missions
Donahue, Benjamin; Cupples, Michael; Green, Shaun; [2003]; 28 pp.; In English; Space Technology and Applications International Forum, 2-5 Feb. 2003, Albuquerque, NM, USA
Contract(s)/Grant(s): GS-231F-0107J; Copyright; Avail: Other Sources; Abstract Only

The paper discusses general ISTA analysis process flow which include following: Technology databases. Vehicle syntheses. Evaluation. System requirements and payoff.
CASI
Power Supplies; Mission Planning; Computer Programs

20030063113 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Low Speed Rot or/Fuselage Interactional Aerodynamics
Barnwell, Richard W.; Prichard, Devon S.; July 18, 2003; 40 pp.; In English
Contract(s)/Grant(s): NCC1-367; No Copyright; Avail: CASI; A03, Hardcopy

This report presents work performed under a Cooperative Research Agreement between Virginia Tech and the NASA Langley Research Center. The work involved development of computational techniques for modeling helicopter rotor/airframe aerodynamic interaction. A brief overview of the problem is presented, the modeling techniques are described, and selected example calculations are briefly discussed.
Author
Computer Programs; Models; Rotor Body Interactions

20030063175 Naval Surface Warfare Center, Panama City, FL
Personal Computer Shallow Water Acoustic Tool-Set (PC SWAT) 7.0: Low Frequency Propagation and Scattering
Sammelmann, Gary S.; Jun. 2002; 143 pp.; In English
Report No.(s): AD-A411652; CSS/TR-02/10; No Copyright; Avail: CASI; A07, Hardcopy

This report describes the theoretical basis behind the low frequency propagation and scattering models used in Personal Computer Shallow Water Acoustics Tool-set (PC SWAT 7. 0). PC SWAT is a user-friendly sonar simulation developed by Dr. Sammelmann. It is used widely throughout the Department of Defense.
DTIC
Scattering; Microcomputers; Sonar; Low Frequencies; Software Development Tools; Mines (Ordnance)

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20030062074 Motorola, Inc., Schaumburg, IL
Adaptive System and Method for Responding to Computer Network Security Attacks
Hill, Douglas W., Inventor; Lynn, James T., Inventor; Jul. 11, 2002; 15 pp.; In English; Original contains color illustrations
Patent Info.: Filed 12 Jan. 1998. patented 11 Jul. 2000; US-Patent-Appl-SN-006-056
Report No.(s): AD-A412132; PATENT-6 088-804; No Copyright; Avail: US Patent and Trademark Office

A dynamic network security system (20) responds to a security attack (92) on a computer network (22) having a multiplicity of computer nodes (24). The security system (20) includes a plurality of security agents (36) that concurrently detect occurrences of security events (50) on associated computer nodes (24). A processor (40) processes the security events (50) that are received from the security agents (36) to form an attack signature (94) of the attack (92). A network status display (42) displays multi-dimensional attack status information representing the attack (92) in a two dimensional image to indicate the overall nature and severity of the attack (92). The network status display (42) also includes a list of recommended actions (112) for mitigating the attack. The security system (20) is adapted to respond to a subsequent attack that has a subsequent signature most closely resembling the attack signature (94).
DTIC
Patents; Data Processing; Computer Security

20030062170 NASA Marshall Space Flight Center, Huntsville, AL, USA
Planning Systems for Distributed Operations
Maxwell, Theresa G.; [2002]; 18 pp.; In English; Ground Systems Architecture Workshops (GSAW), 4-6 Mar. 2003, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation presents an overview of the mission planning process involving distributed operations (such as the International Space Station (ISS)) and the computer hardware and software systems needed to support such an effort. Topics considered include: evolution of distributed planning systems, ISS distributed planning, the Payload Planning System (PPS), future developments in distributed planning systems, Request Oriented Scheduling Engine (ROSE) and Next Generation distributed planning systems.
CASI
Mission Planning; Payload Integration; Space Shuttle Payloads; Systems Engineering; Software Engineering; Project Management; Management Systems

20030062959 NASA Ames Research Center, Moffett Field, CA, USA
Device Control Using Gestures Sensed from EMG
Wheeler, Kevin R.; [2003]; 6 pp.; In English; IEEE International Workshop on Soft Computing in Industrial Applications, 23-25 Jun. 2003, Binghamton, NY, USA; No Copyright; Avail: CASI; A02, Hardcopy

In this paper we present neuro-electric interfaces for virtual device control. The examples presented rely upon sampling Electromyogram data from a participants forearm. This data is then fed into pattern recognition software that has been trained to distinguish gestures from a given gesture set. The pattern recognition software consists of hidden Markov models which are used to recognize the gestures as they are being performed in real-time. Two experiments were conducted to examine the feasibility of this interface technology. The first replicated a virtual joystick interface, and the second replicated a keyboard. Author
Interfaces; Virtual Memory Systems; Electromyography; Pattern Recognition; Human-Computer Interface

20030062962 NASA Ames Research Center, Moffett Field, CA, USA
Intelligent Agents for Science Data Processing
Golden, Keith; April 25, 2003; 14 pp.; In English; ISI Talk, 25 Apr. 2003, Moffett Field, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

In order to conduct research into global warming, the Earth Observing System Data and Information System (EOSDIS) generates a large and growing volume of data. This viewgraph presentation describes the architecture needed to manage the remote sensing data, and the numerical analysis used to process it.
CASI
Eos Data And Information System; Architecture (Computers); Data Management

20030062969 IET Corp Arlington VA
Information Assurance Cyber Ecology
Jorgensen, Jane; Rossignol, Philippe; Jan. 2003; 211 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0020; Proj-IAST
Report No.(s): AD-A411943; AFRL-IF-RS-TR-2003-1; No Copyright; Avail: CASI; A10, Hardcopy

Cyber Ecology is a systems-level discipline addressing the emergent properties of computer networks and their responses to perturbations, such as attacks. It is a cross-disciplinary synthesis incorporating elements of biology, epidemiology, ecology, computer science, and system engineering. In this work, methodologies from epidemiology and ecology were applied to information assurance. The goals of the Cyber Ecology project were to: (1) enable and demonstrate the discovery of noel IA technologies for the detection and mitigation of damage due to cyber attack through the application of ecological models, (2) design, develop, document, evaluate and deliver methodologies to assess the behavior of computer networks from attacks by infectious agents and direct attacks, and (3) develop and demonstrate methods to make system-level assessments about network health. The work in this report spans four major areas: (1) definition and scope of Cyber Ecology, (2) application of ecological concepts to the classification of malicious code, in which insider threat is briefly discussed, (3) epidemiological applications of Cyber Ecology, and 94) system health expressed as emergent properties that can be assessed through evaluation of network (community) structure.
DTIC
Artificial Intelligence; Data Processing; Computer Information Security; Ecology; Computer Networks

20030063136 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Secured Advanced Federated Environment (SAFE): A NASA Solution for Secure Cross-Organization Collaboration

Chow, Edward; Spence, Matthew Chew; Pell, Barney; Stewart, Helen; Korsmeyer, David; Liu, Joseph; Chang, Hsin-Ping; Viernes, Conan; Gogorth, Andre; [2003]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper discusses the challenges and security issues inherent in building complex cross-organizational collaborative projects and software systems within NASA. By applying the design principles of compartmentalization, organizational hierarchy and inter-organizational federation, the Secured Advanced Federated Environment (SAFE) is laying the foundation for a collaborative virtual infrastructure for the NASA community. A key element of SAFE is the Micro Security Domain (MSD) concept, which balances the need to collaborate and the need to enforce enterprise and local security rules. With the SAFE approach, security is an integral component of enterprise software and network design, not an afterthought.
Author

Security; Design Analysis; Software Engineering

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20030062213 Army Science Board, Washington, DC, USA

AD Hoc Study on Human Robot Interface Issues

Mulgaonka, Prasanna; Blair, John; Dodd, Robert; Martinez, David; Perna, Roberta-Diane J.; Sep. 2002; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411834; No Copyright; Avail: CASI; A05, Hardcopy

The Army Science Board Panel was tasked to: (1) Examine Army, DARPA, Navy, Air Force and NASA unmanned ground vehicle (UGV) and unmanned aerial vehicle (UAV) research and development efforts focused on human-machine interfaces, command and control of robots and supervisory control; (2) Project technologies and capabilities into the 2015-2020 timeframe and assess technology voids that may remain; (3) Determine the availability issues for applicable commercial systems and technologies; and (4) Propose cost-effective options or strategies for addressing identified technology voids. The Panel's findings discuss the absence of a systematic study of human-robot interface design and a disconnect between end-users and the development process. The Panel's overall recommendations include: (1) development of an operational architecture with support from experimental data collected in operationally relevant scenarios in realistic environments; (2) Formulation of an FCS Block I human-robot interaction architecture consistent the FCS Operational Requirements Document in time for the FCS Milestone B decision; and (3) Establishment of a Science and Technology program aimed at developing a technical architecture for human robot interactions focused on autonomous ground robots.
DTIC

Interfaces; Robots; Man Machine Systems

20030062824 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Implementation of Autonomous Control Technology for Plant Growth Chambers

Costello, Thomas A.; Sager, John C.; Krumins, Valdis; Wheeler, Raymond M.; 2002 Research Reports NASA/ASEE Fellowship Program; December 2003, pp. 59-70; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Kennedy Space Center has significant infrastructure for research using controlled environment plant growth chambers. Such research supports development of bioregenerative life support technology for long-term space missions. Most of the existing chambers in Hangar L and Little L will be moved to the new Space Experiment Research and Processing Laboratory (SERPL) in the summer of 2003. The impending move has created an opportunity to update the control system technologies to allow for greater flexibility, less labor for set-up and maintenance, better diagnostics, better reliability and easier data retrieval. Part of these improvements can be realized using hardware which communicates through an ethernet connection to a central computer for supervisory control but can be operated independently of the computer during routine run-time. Both the hardware and software functionality of an envisioned system were tested on a prototype plant growth

chamber (CEC-4) in Hangar L. Based upon these tests, recommendations for hardware and software selection and system design for implementation in SERPL are included.
Author
Automatic Control; Phytotrons

20030062905 Massachusetts Inst. of Tech., Cambridge, MA
A Robot for Wrist Rehabilitation
Williams, Dustin J.; Krebs, Hermano I.; Hogan, Neville; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NIH-R01-HD37397-01; NIH-R01-HD36827-02
Report No.(s): AD-A411617; No Copyright; Avail: CASI; A01, Hardcopy

In 1991, a novel robot named MIT-MANUS was introduced as a test bed to study the potential of using robots to assist in and quantify the neuro-rehabilitation of motor function. It proved an excellent fit for the rehabilitation of shoulder and elbow of stroke patients with results in clinical trials showing a reduction of impairment in these joints. The greater reduction in impairment was limited to the group of muscles exercised. This suggests a need for additional robots to rehabilitate other degrees of freedom. This paper outlines the mechanical design of a robot for wrist rehabilitation.
DTIC
Mechanical Properties; Robots; Wrist

20030062986 University of Southern California Engineering Center, Los Angeles, CA, USA
Development of BION(TM) Technology for Functional Electrical Stimulation: Bidirectional Telemetry
Troyk, P. R.; Brown, I. E.; Moore, W. H.; Loeb, G. E.; 25 Oct. 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411723; No Copyright; Avail: CASI; A01, Hardcopy

BIONs(TM) are individually addressable, single channel electrical interfaces that can be injected into one or more muscles through a 12-gauge hypodermic needle. They receive power and command signals from an externally worn RF transmission coil and generate stimulation pulses to activate motor units. In order to reanimate useful function in a paralyzed limb, it is necessary to incorporate sensors and back telemetry to provide voluntary control and sensory feedback signals. We describe and compare several sensing modalities and bi-directional telemetry schemes that have been developed and are being evaluated to support these requirements.
DTIC
Stimulation; Telemetry; Measuring Instruments; Bionics; Detection

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030062054 Firat Univ., Elazig, Turkey
An Intelligent Pattern Recognition System Based on Neural Network and Wavelet Decomposition for Interpretation of Heart Sounds
Turkoglu, I.; Arslan, A.; 25 Oct. 2001; 5 pp.; In English
Report No.(s): AD-A411866; No Copyright; Avail: CASI; A01, Hardcopy

In this study, we develop a new automated pattern recognition system for interpretation of heart sound based on wavelet decomposition of signals and classification using neural network. Inputs to the system are the heart sound signals acquired by a stethoscope in a noiseless environment. We generate features for the objective concise representation of heart sound signals by means of wavelet decomposition. Classification of the features is performed using a back propagation neural network with adaptive learning rate. With two hundred record windows obtained from young humans are studied. One hundred of the record windows in database are selected for use as training phase for neural network. In the test result of the intelligent pattern recognition system with ten different types heart sound signals are acquired a high success.
DTIC
Pattern Recognition; Phonocardiography

20030062055 Stanford Univ., Stanford, CA

Assessment of an Optical Flow Field-Based Polyp Detector for CT colonography

Acar, B.; Beaulieu, C. F.; Paik, D. S.; Goekturk, S. B.; Tomasi, C.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411867; No Copyright; Avail: CASI; A01, Hardcopy

Most current computer-aided detection (CAD) algorithms for the fully automatic detection of colonic polyps from 3D CT data suffer from high false positive rates. We developed and evaluated a post-processing algorithm to decrease the false positive rate of such a method. Our method attempts to model the way a radiologist recognizes a polyp while scrolling a cross-sectional plane through 3D CT data by quantifying the change in location of the edges in 2D plane. It uses a classifier for identification base on the Mahalanobis distance. The new method increase the ROC curve area from 0.89 to 0.98 (an increase from 34.5\% to 85.0\% in specificity for 100\% sensitivity) in a population of 8 patients.

DTIC

Computer Aided Tomography; Transformations (Mathematics)

20030062103 NASA Marshall Space Flight Center, Huntsville, AL, USA

Optimization Based Efficiencies in First Order Reliability Analysis

Peck, Jeffrey A.; Mahadevan, Sankaran; [2003]; 4 pp.; In English; 44th American Institute of Aeronautics and Astronautics (AIAA) Structures, Structural Dynamics, and Materials Conference, 7-10 Apr. 2003, Norfolk, VA, USA; Copyright; Avail: CASI; A01, Hardcopy

This paper develops a method for updating the gradient vector of the limit state function in reliability analysis using Broyden's rank one updating technique. In problems that use commercial code as a black box, the gradient calculations are usually done using a finite difference approach, which becomes very expensive for large system models. The proposed method replaces the finite difference gradient calculations in a standard first order reliability method (FORM) with Broyden's Quasi-Newton technique. The resulting algorithm of Broyden updates within a FORM framework (BFORM) is used to run several example problems, and the results compared to standard FORM results. It is found that BFORM typically requires fewer functional evaluations that FORM to converge to the same answer.

Author

Reliability Analysis; Finite Difference Theory; Gradients; Nonlinear Equations; Mathematical Programming

20030062147 Universidad Autonoma Metropolitana de Mexico, Mexico

Parameters and Filters for Low Bit Rate Wavelet Packet Compression of Magnetic Resonance Images

Azpiroz-Leehan, J.; Lerallut, J. F.; Oct. 25, 2001; 6 pp.; In English

Report No.(s): AD-A412043; No Copyright; Avail: CASI; A02, Hardcopy

We present an analysis of the characteristics of different filters for the compression of magnetic resonance images. Compression rates were 33:1 and 50:1, We compare the performance among different types of wavelets presented in the literature and provide quantitative (percentage of energy retained, peak signal to noise ratio) and qualitative (analysis by a group of seven experts) data to support our conclusions, Different types of coiflets, symlets and biorthogonal wavelets are analyzed, and we conclude that for the images under study (T1 weighed images in three planes), the best results are provided by the biorthogonal spline (Daubechies) wavelet 2,6. Several explanations for these results are mentioned,

DTIC

Magnetic Resonance; Imaging Techniques; Image Processing

20030062150 Politecnico di Milano, Milan, Italy

A Wavelet-Packet Method for the Identification of Ventilator Influence on Heart Rate Variability

Mainardi, L. T.; Korhonen, I.; Bonacina, S.; Cerutti, S.; Oct. 25, 2001; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A412049; No Copyright; Avail: CASI; A01, Hardcopy

We studied the respiratory related modifications of RR interval (RRI) variability in post-operative, artificially ventilated patients during their recovery from anesthesia after cardiac surgery. An ARX model was used to exploit the relationships between RRI and respiration in sub-bands signals obtained through Wavelets packets decomposition. We found that the recovery from anesthesia is accompanied by progressive reduction of the influence of ventilation on RR variability and by the reappearance of physiological modulations of the sinus node activity.

DTIC

Respiration; Modulation

20030062187 NASA Marshall Space Flight Center, Huntsville, AL, USA

ISS Space-Based Science Operations Grid for the Ground Systems Architecture Workshop (GSAW)

Welch, Clara; Bradford, Bob; [2003]; 17 pp.; In English; Ground System Architectures Workshops (GSAW), 4-6 Mar. 2003, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following:What is grid? Benefits of a grid to space-based science operations. Our approach. Score of prototype grid. The security question. Short term objectives. Long term objectives. Space-based services required for operations. The prototype. Score of prototype grid. Prototype service layout. Space-based science grid service components. CASI

Science; Security; Computational Grids; Prototypes

20030062192 NASA Glenn Research Center, Cleveland, OH, USA

Analysis and Improvement of Upwind and Centered Schemes on Quadrilateral and Triangular Meshes

Huynh, H. T.; June 2003; 40 pp.; In English; 16th Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA

Contract(s)/Grant(s): WBS-22-781-30-12

Report No.(s): NASA/TM-2003-212389; NAS 1.15:212389; E-13966; AIAA Paper 2003-3541; No Copyright; Avail: CASI; A03, Hardcopy

Second-order accurate upwind and centered schemes are presented in a framework that facilitates their analysis and comparison. The upwind scheme employed consists of a reconstruction step (MUSCL approach) followed by an upwind step (Roe's flux-difference splitting). The two centered schemes are of Lax-Friedrichs (L-F) type. They are the nonstaggered versions of the Nessyahu-Tadmor (N-T) scheme and the CE/SE method with epilson = 1/2. The upwind scheme is extended to the case of two spatial dimensions (2D) in a straightforward manner. The N-T and CE/SE schemes are extended in a manner similar to the 2D extensions of the CE/SE scheme by Wang and Chang for a triangular mesh and by Zhang, Yu, and Chang for a quadrilateral mesh. The slope estimates, however, are simplified. Fourier stability and accuracy analyses are carried out for these schemes for the standard 1D and the 2D quadrilateral mesh cases. In the nonstandard case of a triangular mesh, the triangles must be paired up when analyzing the upwind and N-T schemes. An observation resulting in an extended N-T scheme which is faster and uses only one-third of the storage for flow data compared with the CE/SE method is presented. Numerical results are shown. Other improvements to the schemes are discussed.

Author

Upwind Schemes (Mathematics); Computational Fluid Dynamics; Finite Difference Theory; Euler Equations Of Motion; Structured Grids (Mathematics)

20030062212 Technische Univ., Graz

Linear Approaches for the Reconstruction of Epicardial and Transmembrane Potential Patterns

Messnarz, B.; Tilg, B.; Modre, R.; Fischer, G.; Hanser, F.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A411828; No Copyright; Avail: CASI; A01, Hardcopy

In this study we compare two different linear inverse approaches to the inverse problem of electrocardiography. Method A is the standard Tikhonov zero order approach used as a reference method. Method B is based on the general deconvolution theorem proposed by Greensite. Both methods are applied to both the epicardial potential and the transmembrane potential considered as the primary source. In order to compare the performance of both methods the activation time pattern is estimated.

DTIC

Electrocardiography; Numerical Analysis

20030062763 NASA Ames Research Center, Moffett Field, CA, USA

A Bayesian Approach to Sensor Characterization

Timucin, Dogan A.; May 05, 2003; 3 pp.; In English; IEEE IGARSS, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy

The physical model of a generic electro-optic sensor is derived and incorporated into a Bayesian framework for the estimation of key instrument parameters from calibration data. The sensor characterization thus achieved enables optimal

subsequent removal of instrument effects from field data, leading to the highest possible accuracy in the retrieved physical quantities.
Author
Bayes Theorem; Signal Detectors; Signal Processing; Electro-Optics; Electromagnetic Interference; Mathematical Models; Optimization

20030062784 Applied Computational Electromagnetics Society, USA
Applied Computational Electromagnetics Society Journal, Volume 17, No. 3
Elsherbeni, Atef Z.; Nov. 2002; 80 pp.; In English
Report No.(s): AD-A412338; No Copyright; Avail: CASI; A05, Hardcopy

The Applied Computational Electromagnetics Society (ACES) Journal hereinafter known as the ACES Journal is devoted to the exchange of information in computational electromagnetics, to the advancement of the state-of-the art, and the promotion of related technical activities. A primary objective of the information exchange is the elimination of the need to 'reinvent the wheel' to solve a previously-solved computational problem in electrical engineering, physics, or related fields of study. The technical activities promoted by this publication include code validation, performance analysis, and input/output standardization; code or technique optimization and error minimization; innovations in solution technique or in data input/output; identification of new applications for electromagnetics modeling codes and techniques; integration of computational electromagnetics techniques with new computer architectures; and correlation of computational parameters with physical mechanisms.
DTIC
Computation; Electromagnetism

20030062841 Mississippi State Univ., Mississippi State, MS, USA
The Loci Multidisciplinary Simulation System
Luke, Ed; [2002]; 13 pp.; In English; NASA/MSFC Fall Fluids Workshop, 19-21 Nov. 2002
Contract(s)/Grant(s): NAS13-98033; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. An overview of the Loci Multidisciplinary Simulation System. 2. Topologically adaptive mesh generation. 3. Multidisciplinary simulations using Loci with the CHEM chemically reacting flow solver.
Derived from text
Simulation; Topology; Loci; Grid Generation (Mathematics)

20030062900 Army Aviation Systems Command, Moffett Field, CA, USA
Numerical Predictions of Wind Turbine Power and Aerodynamic Loads for the NREL Phase II and IV Combined Experiment Rotor
Duque, Earl P. N.; Johnson, Wayne; vanDam, C. P.; Chao, David D.; Cortes, Regina; Yee, Karen; May 20, 1999; 4 pp.; In English; Joint ASME/AIAA Wind Energy Symposium, Jan. 2000, Reno, NV, USA; Copyright; Avail: CASI; A01, Hardcopy

Accurate, reliable and robust numerical predictions of wind turbine rotor power remain a challenge to the wind energy industry. The literature reports various methods that compare predictions to experiments. The methods vary from Blade Element Momentum Theory (BEM), Vortex Lattice (VL), to variants of Reynolds-averaged Navier-Stokes (RaNS). The BEM and VL methods consistently show discrepancies in predicting rotor power at higher wind speeds mainly due to inadequacies with inboard stall and stall delay models. The RaNS methodologies show promise in predicting blade stall. However, inaccurate rotor vortex wake convection, boundary layer turbulence modeling and grid resolution has limited their accuracy. In addition, the inherently unsteady stalled flow conditions become computationally expensive for even the best endowed research labs. Although numerical power predictions have been compared to experiment. The availability of good wind turbine data sufficient for code validation experimental data that has been extracted from the IEA Annex XIV download site for the NREL Combined Experiment phase II and phase IV rotor. In addition, the comparisons will show data that has been further reduced into steady wind and zero yaw conditions suitable for comparisons to 'steady wind' rotor power predictions. In summary, the paper will present and discuss the capabilities and limitations of the three numerical methods and make available a database of experimental data suitable to help other numerical methods practitioners validate their own work.
Author
Numerical Analysis; Wind Turbines; Aerodynamic Loads; Rotors; Turbulent Boundary Layer

20030062940 Woods Hole Oceanographic Inst., MA, USA

A Finescale Lagrangian Instrument System

Toole, John M.; Mar. 20, 2003; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0163

Report No.(s): AD-A412176; No Copyright; Avail: CASI; A02, Hardcopy

A new deployment scheme for the Moored Profiler instrument in which the vehicle cycles along a freely-drifting tether was designed and field tested. The goal of the drifting tether system is to acquire finescale temporal information that is less contaminated by Doppler shifting by the large-scale background flow than is achievable from conventional, bottom-anchored moorings. An initial trial of the concept targeting the upper ocean was carried out off Bermuda in November 2001 with an instrument profiling between 12 and 28O-m depth. The result- ant temperature and salinity data were of good quality and clearly documented diurnal stratification changes at the surface. Individual velocity profile data exhibited significant 'noise' in the upper 75 m due to surface wave motions; at greater depth this noise was greatly reduced. And despite the wave noise, inertial oscillations in the surface mixed layer were clearly evident after modest temporal and depth filtering. Based on this successful trial, plans have been made to use the instrument system in an upcoming study of deep winter convection and Eighteen Degree Water formation.

DTIC

Mooring; Instruments; Lagrangian Function

20030062983 Baylor Coll. of Medicine, Houston, TX

Advances in Noncontact Endocardial Mapping

Khoury, D. S.; Rao, L.; Oct. 25, 2001; 3 pp.; In English

Report No.(s): AD-A411697; No Copyright; Avail: CASI; A01, Hardcopy

We globally investigated (1) the properties of noncontact cardiac electrograms measured by multielectrode cavitary probes, (2) the features of endocardial electrograms computed from the noncontact probe electrograms, and (3) the impact of the probe size on both the noncontact and the computed electrograms. We deployed a custom catheter in the dog RA, which consisted of a cylindrical probe with 64 electrodes on its surface, for measuring noncontact cavitary electrograms, and a concentric endocardial basket carrying an additional array of 64 electrodes, for measuring contact endocardial electrograms. Both a 5-mm and a 10-mm diameter probe were sequentially tested daring normal as well as during paced rhythms. Boundary element method and numeric regularization were applied to compute endocardial electrograms at the basket electrode locations. We found that noncontact electrograms were attenuated and smoothed, and this effect was exaggerated with the small probe. Computed endocardial electrograms more accurately reconstructed important amplitude distribution and morphological features. In conclusion, global RA activation may be delineated directly from noncontact cavitary electrograms alone, bat may be affected by volume attenuation, smoothing, and probe size. Accurate endocardial electrograms, however, can be successfully computed from noncontact electrograms acquired with small probes.

DTIC

Electrodes; Electrocardiography; Medical Equipment; Mapping; Measuring Instruments

20030063023 Massachusetts Inst. of Tech., Cambridge, MA

Removing Signal Intensity Inhomogeneity From Surface Coil MRI Using Discrete Wavelet Transform and Wavelet Packet

Lin, Fa-Hsuan; Chen, Ying-Jui; Belliveau, John W.; Wald, Lawrence L.; Oct. 25, 2001; 5 pp.; In English

Report No.(s): AD-A412082; No Copyright; Avail: CASI; A01, Hardcopy

We evaluate a combined discrete wavelet transform (DWT) and wavelet packet algorithm to improve the homogeneity of magnetic resonance imaging when a surface coil is used for reception. The proposed algorithm estimates the spatial sensitivity profile of the surface coil from the original anatomical image and uses this information to normalize the image intensity variations. Estimation of the coil sensitivity profile based on the wavelet transform of the original image data is found to provide a robust method for removing the slowly varying spatial sensitivity pattern.

DTIC

Coils; Imaging Techniques; Wavelet Analysis; Magnetic Resonance

20030063177 Wake Forest Univ., Winston-Salem, NC, USA

MR Tagging From a Signal Processing Perspective

Bayram, Ersin; Hamilton, Craig A.; Hundley, W. G.; Oct. 25, 2001; 5 pp.; In English

Report No.(s): AD-A411083; No Copyright; Avail: CASI; A01, Hardcopy

Although magnetic resonance (MR) tagging has been shown to be a useful tool in myocardial motion quantification, its clinical utilization is limited as current available methods generally either lack computational speed or require extensive user intervention. Recently, the harmonic phase imaging (HARP) technique has been proposed to look at the phase information of the tagged images. HARP imaging promises to overcome the limitations of existing methods in terms of both computational speed and automation. Motivated by this work, we present mathematical analysis providing a signal processing perspective on the HARP technique. This new perspective provides a clearer understanding of how tags can be accurately tracked using highly-filtered data.
DTIC
Signal Processing; Fourier Transformation

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030062072 International Business Machines Corp., Armonk, NY
Methods and Apparatus for Correlating Biometric Attributes and Biometric Attribute Production Features
Herman-Maes, Stephane, Inventor; Zweig, Geoffrey G., Inventor; Jun. 25, 2002; 15 pp.; In English; Original contains color illustrations
Patent Info.: Filed 22 Nov. 1999, patented 25 Jun. 2002; US-Patent-Appl-SN-444-684
Report No.(s): AD-A412131; PATENT-6 411-933; No Copyright; Avail: US Patent and Trademark Office
A method of validating production of a biometric attribute allegedly associated with a user comprises the following steps. A first signal is generated representing data associated with the biometric attribute allegedly received in association with the user. A second signal is also generated representing data associated with at least one feature detected in association with the production of the biometric attribute allegedly received from the user. Then, the first signal and the second signal are compared to determine a correlation level between the biometric attribute and the production feature, wherein the validation of the production of the biometric attribute depends on the correlation level. Accordingly, the invention serves to provide substantial assurance that the biometric attribute offered by the user has been physically generated by the user.
DTIC
Patents; Biometrics

20030062145 Alberta Univ., Edmonton, Alberta, Canada
Dynamic Edge Tracing for 2D Image Segmentation
Withey, D. J.; Koles, Z. J.; Pedrycz, W.; 25 Oct. 2001; 5 pp.; In English
Report No.(s): AD-A412095; No Copyright; Avail: CASI; A01, Hardcopy
A novel segmentation technique which may be useful for two dimensional (2D) magnetic resonance (MR) image segmentation is presented. The technique utilizes a dynamic target tracking algorithm and a Kalman filter and permits edges to be followed in the presence of intensity variation similar to that found in MR images. Segmentation of two synthetic test images, one with intensity nonuniformity and one without, is performed. Fuzzy c-means clustering with pixel intensity features is used to segment the same test images for qualitative comparison.
DTIC
Image Processing; Magnetic Resonance; Imaging Techniques

20030062207 Tehran Univ., Tehran, Iran (Islamic Republic of)
EEG Signals Can Be Used to Detect the Voluntary Hand Movements by Using an Enhanced Resource-Allocating Neural Network
Erfanian, Abbas; Gerivany, Mahdi; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411797; No Copyright; Avail: CASI; A01, Hardcopy
This article explores the use of single trial EEG signals to predict the voluntary movements of single hand and two hands. During single-hand movements, three kinds of task, grasping, releasing, and holding were considered. The tasks considered during two-hand movements are left and right grasping, left and right releasing, and holding. The subject performs the tasks spontaneously without waiting for and responding to any external cues. In addition, a neural adaptive noise canceller is developed that accomplishes eye blinks suppression. The neural adaptive filter is here implemented by means of a three-layer feed-forward neural network. The feature vectors are formed from the three channels (Fz, C3, and F3). We employ the

multilayer perceptron (MLP) with back-propagation learning algorithm and Radial Basis Function (RBF) network with stochastic gradient learning rule for discriminating different patterns of the EEG signals. In the classical approach to RBF and MLP network implementation, the number of hidden units is predetermined. It, usually, results in too many hidden units. To overcome this drawback, we develop an enhanced resource-allocating network (RAN) for discriminating the EEG patterns. These networks start with no hidden units and grow by allocating new hidden units based on the novelty in the EEG signals, which arrive sequentially. The results of this analysis show that the neural networks would be able to detect the movements of a single hand and two hands with an average classification accuracy of 98.82\% and 96.40\%, respectively. Moreover, the RAN provides a reduction in the training epochs as compared to the MLP and RBF networks. This work represents a promising approach to control prosthesis device.
DTIC
Signal Processing; Neural Nets

20030062870 Norfolk State Univ., VA, USA
Statistical Process Control: The Manufacturer's Best Friend
Douglas, Ransom West; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 469-475; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, the improvement of product quality in a manufacturing outfit utilizing dual methods are presented. Hidden causes for poor quality are identified through the use of a flow chart to provide the basis for problem analysis. Traditional control charts for variables are not suitable under certain manufacturing environment, thus necessitating the application of non-conventional methods involving pre-control charts. The objective is to demonstrate the application of non traditional Statistical Process Control (SPC) techniques in monitoring and controlling manufacturing processes involving lower production rates and smaller lot sizes.
CASI
Manufacturing; Product Development; Statistical Analysis; Process Control (Industry)

20030062903 Patras Univ., Greece
Ultrasound Image Denoising via Maximum a Posteriori Estimation of Wavelet Coefficients
Achim, A.; Bezerianos, A.; Tsakalides, P.; Oct. 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411631; No Copyright; Avail: CASI; A01, Hardcopy

Speckle noise removal by means of digital image processors could improve the diagnostic potential of medical ultrasound. This paper addresses the speckle suppression issue wit bin the framework of wave let analysis. As a first step of our approach, the logarithm of the original image is decomposed into several scales through a multiresolution analysis employing the 2-D wavelet transform. Then, we design a maximum a posteriori (MAP) estimator, which relies on a recently introduced statistical representation for the wavelet coefficients of ultrasound images. We use an alpha-stable model to develop a blind noise-removal processor that performs a non-linear operation on the data. Finally we compare our technique to current state-of-the-art denoising methods applied on actual ultrasound images and we find it more effective both in terms of speckle reduction and signal detail preservation.
DTIC
Noise Reduction; Ultrasonic Tests; Ultrasonics

20030062922 La Sapienza Univ., Rome, Italy
Multimodal Integration of High Resolution EEG and Functional Magnetic Resonance: a Simulation Study
Babiloni, Fabio; Babiloni, Claudio; Carducci, Filippo; Angelone, Leonardo; Del Gratta, Cosimo; 25 Oct. 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411862; No Copyright; Avail: CASI; A01, Hardcopy

In this simulation study, we would like to address some questions related to the use of fMRI a priori constraints in the estimation of the cortical source current density. Namely, we would like to assess the utility to include information as estimated from event-related and block-design fMRI, by using as the dependent variable the correlation between the imposed and the estimated waveforms at the level of cortical region of interests (ROI). A realistic head and cortical surface model was used. Factors used were i) the signal to noise ratio of the scalp simulated data (SNR); ii) the particular inverse operator used to estimate the cortical source activity from the simulated scalp data (INVERSE); iii) the strength of the fMRI priors in the estimation of the current activity (K). Analysis of Variance (ANOVA) results revealed that all the considered factors (SNR,

INVERSE, K) significantly afflicts the correlation between the estimated and the simulated cortical activity. For the ROIs analyzed in which a presence of fMRI hotspots were simulated, it was observed that the best estimation of cortical source currents were performed with the inverse operator that use the event-related fMRI information. When the ROI analyzed do not present fMRI hotspots, both minimum norm and fMRI-based inverse operators return statistically equivalent correlation values. Such results open the avenue for the use of fMRI-based inverse operator in the estimation of cortical current strengths from motor and cognitive task in the human brain.
DTIC
Electroencephalography; Signal To Noise Ratios; Magnetic Resonance; Imaging Techniques

20030062928 Duke Univ., Durham, NC, USA
Computer Aid for the Decision to Biopsy Breast Lesions
Floyd, Carey E., Jr.; Jul. 2001; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9174
Report No.(s): AD-A411916; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is to improve the accuracy of the diagnosis of breast cancer from mammograms by using a computer-based system to provide the mammographer with a second opinion on whether or not to perform a biopsy. An estimated 2\% to 10\% of true cancers are not biopsied but are instead followed, while between 60\% and 90\% of breast biopsies are performed on benign lesions. This report documents progress that has been made in improving the accuracy of diagnoses from mammograms using a Case-Based Reasoning (CBR) approach. The CBR approach predicts the outcome of a biopsy from the known biopsy outcomes for similar cases. The current version of the CBR performs with an accuracy of 61\% on a retrospective set of consecutive cases for which the clinical diagnostic accuracy was 35\%. The CBR algorithm has four fundamental tasks: (1) specify a reference set of cases, (2) define a metric for the distance between cases, (3) define a rule (based on the distance metric) for selecting 'similar' cases from the reference set, and (4) specify a classification technique for predicting the outcome of biopsy from the known outcomes of similar reference cases. The reference database for this study contained about 1500 cases that were referred for biopsy at Duke University Medical Center between 1992 and 2000. Each case included the mammographer's description of the lesion using the BI-RADS (TM) lexicon, known risk factors, and outcomes in the form of benign or malignant status as determined by biopsy. At a sensitivity of 0.98 relative to all biopsied lesions, the specificity of CBR was found to be 0.4. Thus, through the use of CBR 40\% of the benign biopsies could have been avoided at the cost of delaying diagnosis for 2\% of the malignancies. The results demonstrate the feasibility of developing CBR as a decision aid for breast biopsy using the BI-RADS lexicon to index the cases.
DTIC
Decision Making; Neoplasms; Computer Aided Tomography

20030062946 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
DSMC Study of Flowfield and Kinetic Effects on Vibrational Excitations in Jet-Freestream Interactions
Campbell, David H.; May 15, 2002; 3 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A410985; AFRL-PR-ED-AB-2002-113; No Copyright; Avail: CASI; A01, Hardcopy

Vibrational excitation of molecular species emitting from a jet into a high-speed free stream is a process with importance to the prediction of high-altitude rocket exhaust plume infrared emissions. Accurate predictions of these emissions are necessary for the analysis of potential optical interference of on-vehicle instrumentation. Unfortunately, accurate vibrational excitation collision cross sections are not always available for the species pairs of interest and for the high relative energies encountered in this situation. In addition, accurate nozzle exit plane flowfield characteristics are always a challenge to calculate accurately. The results of a study to characterize the sensitivity of predicted vibrational excitation to the vibrational excitation cross section and the nozzle exit plane profile will be presented in this paper. The Direct Simulation Monte Carlo (DSMC) computational technique was used to simulate the interaction between a carbon monoxide jet and a high velocity free steam of oxygen atoms oriented at 900 degrees to the jet flow axis at 150 kilometers simulated altitude. A literature value of the vibrational excitation cross section is used as a baseline, and comparative simulations are made for cross sections that vary around that value. Similarly, the nozzle exit plane profile is varied from a 'flat' profile to a fully developed laminar boundary layer profile to obtain sensitivities to the jet inflow startline. SMILE, a software system based on the DSMC method, developed at the Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia, has been utilized for this study. This code is capable of fully 3-D parallel calculations, and has a graphical user interface, xSMILE, that automates the process of

setting up a case, running the main SMILE code, and obtaining output in a useable form.
DTIC
Flow Distribution; Jet Flow; Reaction Kinetics; Monte Carlo Method; Excitation; Computerized Simulation

20030062956 NASA Ames Research Center, Moffett Field, CA, USA
Discovering Communicable Models from Earth Science Data
Schwabacher, Mark; Langley, Pat; Potter, Christopher; Klooster, Steven; Torregrosa, Alicia; August 19, 2002; 21 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

This chapter describes how we used regression rules to improve upon results previously published in the Earth science literature. In such a scientific application of machine learning, it is crucially important for the learned models to be understandable and communicable. We recount how we selected a learning algorithm to maximize communicability, and then describe two visualization techniques that we developed to aid in understanding the model by exploiting the spatial nature of the data. We also report how evaluating the learned models across time let us discover an error in the data.
Author
Earth Sciences; Regression Analysis; Models

20030063015 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Maximally Informative Statistics for Localization and Mapping
Deans, Matthew C.; October 2001; 14 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-01.25; Copyright; Avail: CASI; A03, Hardcopy

This paper presents an algorithm for localization and mapping for a mobile robot using monocular vision and odometry as its means of sensing. The approach uses the Variable State Dimension filtering (VSDF) framework to combine aspects of Extended Kalman filtering and nonlinear batch optimization. This paper describes two primary improvements to the VSDF. The first is to use an interpolation scheme based on Gaussian quadrature to linearize measurements rather than relying on analytic Jacobians. The second is to replace the inverse covariance matrix in the VSDF with its Cholesky factor to improve the computational complexity. Results of applying the filter to the problem of localization and mapping with omnidirectional vision are presented.
Author
Algorithms; Statistical Analysis; Linearization; Optimization; Kalman Filters; Position (Location); Conformal Mapping

20030063181 National Inst. of Advanced Industrial Science and Technology, Tohoku, Japan
Evaluation of Heart Rate Variability by Using Wavelet Transform and a Recurrent Neural Network
Fukuda, Osamu; Nagata, Yoshihiko; Homma, Keiko; Tsuji, Toshio; Oct. 25, 2001; 5 pp.; In English
Report No.(s): AD-A411109; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this paper is to evaluate the physical and mental stress based on the physiological index, and a new evaluation method of heart rate variability is proposed. This method combines the wavelet transform with a recurrent neural network. The features of the proposed method are as follows: 1. The wavelet transform is utilized for the feature extraction so that the local change of heart rate variability in the time-frequency domain can be extracted 2. In order to learn and evaluate the different patterns of heart rate variability caused by individual variations, body conditions, circadian rhythms and so on, a new recurrent neural network which incorporates a hidden Markov Model is used in the experiments, a mental workload was given to five subjects, and the subjective rating scores of their mental stress were evaluated using heart rate variability. It was confirmed from the experiments that the proposed method could achieve high learning/evaluating performances.
DTIC
Markov Processes; Electrocardiography; Wavelet Analysis

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030062069 NASA Marshall Space Flight Center, Huntsville, AL, USA
Systems Engineering Approach to Technology Integration for NASA's 2nd Generation Reusable Launch Vehicle
Thomas, Dale; Smith, Charles; Thomas, Leann; Kittredge, Sheryl; [2002]; 1 pp.; In English; Space Technology Applications International Forum, 2-6 Feb. 2003, Albuquerque, NM, USA; Copyright; Avail: Other Sources; Abstract Only

The overall goal of the 2nd Generation RLV Program is to substantially reduce technical and business risks associated with developing a new class of reusable launch vehicles. NASA's specific goals are to improve the safety of a 2nd-generation system by 2 orders of magnitude - equivalent to a crew risk of 1-in-10,000 missions - and decrease the cost tenfold, to approximately $1,000 per pound of payload launched. Architecture definition is being conducted in parallel with the maturating of key technologies specifically identified to improve safety and reliability, while reducing operational costs. An architecture broadly includes an Earth-to-orbit reusable launch vehicle, on-orbit transfer vehicles and upper stages, mission planning, ground and flight operations, and support infrastructure, both on the ground and in orbit. The systems engineering approach ensures that the technologies developed - such as lightweight structures, long-life rocket engines, reliable crew escape, and robust thermal protection systems - will synergistically integrate into the optimum vehicle. To best direct technology development decisions, analytical models are employed to accurately predict the benefits of each technology toward potential space transportation architectures as well as the risks associated with each technology. Rigorous systems analysis provides the foundation for assessing progress toward safety and cost goals. The systems engineering review process factors in comprehensive budget estimates, detailed project schedules, and business and performance plans, against the goals of safety, reliability, and cost, in addition to overall technical feasibility. This approach forms the basis for investment decisions in the 2nd Generation RLV Program's risk-reduction activities. Through this process, NASA will continually refine its specialized needs and identify where Defense and commercial requirements overlap those of civil missions.
Author
Reusable Launch Vehicles; Risk; Safety; Reliability; Flight Operations; Ground Operational Support System; Mission Planning

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20030062096 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Promise of Macromolecular Crystallization in Micro-fluidic Chips
vanderWoerd, Mark; Ferree, Darren; Pusey, Marc; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Micro-fluidics, or lab on a chip technology, is proving to be a powerful, rapid, and efficient approach to a wide variety of bio-analytical and microscale bio-preparative needs. The low materials consumption, combined with the potential for packing a large number of experiments in a few cubic centimeters, makes it an attractive technique for both initial screening and subsequent optimization of macromolecular crystallization conditions. Screening operations, which require equilibrating macromolecule solution with a standard set of premixed solutions, are relatively straightforward and have been successfully demonstrated in a micro-fluidics platform. More complex optimization methods, where crystallization solutions are independently formulated from a range of stock solutions, are considerably more complex and have yet to be demonstrated. To be competitive with either approach, a micro-fluidics system must offer ease of operation, be able to maintain a sealed environment over several weeks to months, and give ready access for the observation of crystals as they are grown.
Author
Fluidics; Crystallization; Crystals; Chips

20030062210 Technical Research Centre of Finland, Tampere, Finland
Comparison of Linear and Non-Linear Analysis of Heart Rate Variability in Sedated Cardiac Surgery Patients
Korhonen, L.; Mainardi, L. T.; Yppaerilae, H.; Musialowicz, T.; 25 Oct. 2001; 5 pp.; In English
Report No.(s): AD-A411817; No Copyright; Avail: CASI; A01, Hardcopy

Heart rate variability (HRV) provides a nonvasive method to monitor functioning of the autonomous nervous system. HRV has been proposed as a potential tool for objective assessment of the level of sedation in critical care. In this paper we studied whether different linear and non-linear analysis methods may discriminate different levels of sedation in cardiac surgery patients. In addition we studied the interrelationships between the different parameters. The results show that HRV is modified by changes in the level of sedation, and that it is not completely recovered by the next day after the cardiac surgery. Both linear time and frequency domain parameters, and non-linear parameters discriminate the different levels, but especially

the method based on Poincare plot analysis seems promising. As different parameters are closely correlated, a sub-set of parameters may be sufficient in the quantification of HRV in sedation.
DTIC
Linear Systems; Nonlinear Systems; Surgery; Heart Rate; Patients

20030062865 State Univ. of Southeast Missouri, Cape Girardeau, MO, USA
Distribution of Electromagnetic Energy in a Microwave Oven, Part 2
Dahiya, J. N.; Choudhary, Pankaj; Anand, Aman; Roberts, J. A.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 83-94; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A few experiments have been conducted to try to model the microwave distribution inside a microwave oven using a variety of methods. In 1990, Alistair Steyn-Ross of the University of Waikato and Alister Riddell of the Hamilton Boys High School conducted an experiment to test for the existence of standing wave patterns inside a microwave oven. They used a paper towel dipped in a concentrated CoCl2 solution, a common method used to test for water. When the compound is wet, a pink, hydrated Co(H2O)(+2) complex is formed. When the compound is dry, the blue anhydrous CoCl2 compound is present. The team heated the paper for 15 seconds at ten different heights and recorded the pattern of blue and pink areas. They discovered a series of blue dots evenly spaced on the pink towel. They also noticed that the placement of these wet and dry spots changed as the height was changed. Nearly eight years later, Jouni Viiri of North Karelia Polytechnic performed a similar experiment using a sheet of acrylic. Viiri took a thermogram of the sheet after 35 seconds of heating at different heights. Viiri also noticed hot and cold spots, and the location of the spots changed as the height changed. Steyn-Ross and Riddell's experiment proved the existence of standing waves inside a microwave oven and characterized their distribution. Viiri's experiment measured the temperature difference between these hot and cold spots. In 1999, M. F. Diprose of the University of Sheffield conducted a series of experiments to determine the parameters under which a microwave oven should be used in a laboratory. They used a variety of samples, including water and soil, in containers of different shapes and sizes. They used thermocouples to measure the temperatures at different locations within the sample. Their research resulted in an excellent reference as to what variables one should keep in mind when using a microwave oven in the laboratory. Our experiment intends to build upon these discoveries by measuring the effect, or lack thereof, of rotating a sample inside a microwave oven.
Derived from text
Microwaves; Electromagnetism; Temperature Distribution; Ovens; Standing Waves

20030062884 Exploratorium, San Francisco, CA, USA
Science Explorations with Simple Materials From the Exploratorium
Doherty, Paul; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 247-256; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Exploratorium is an educational institution in San Francisco which holds workshops for science teachers and students. The instutution has published a book of science activities. The Teacher Institute (TI) at the Exploratorium has a TI Beginning Teacher Program and a TI Leadership Program in its Teacher Induction Program. This presentation also covers other Exploratorium resources.
CASI
Education; Instructors; Science

20030062972 Materials Technologies Inc. DBA Tensiodyne Scientific Corp Los Angeles CA
Nondestructive Evaluation (NDE) Technology Initiatives. Delivery Order 0021: Application of an Electrochemical Fatigue Sensor (EFS) Borescope System for Military Turbine Engine Assessment
Krupa, R.; Tillinghast, R.; Root, T.; Oct. 2002; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-97-D-5271; Proj-4349
Report No.(s): AD-A411982; ES0408; AFRL-ML-WP-TR-2003-4022; No Copyright; Avail: CASI; A03, Hardcopy

The objective for this project was to improve the USA Air Force's capability to perform fatigue assessment of military aircraft engines through the application of four nondestructive technologies: eddy current inspection, ultrasonic inspection, visual inspection, and the electrochemical fatigue sensor (EFS). EFS is a relatively new technology; the other three inspection methodologies are well established and widely accepted means of component inspection. A 6-mm-diameter inspection

borescope, capable of delivering ultrasonic, eddy current, and EFS probes, along with video imaging, to fatigue critical locations within an engine has been developed.
DTIC
Endoscopes; Nondestructive Tests; Turbine Engines; Sensors; Electrochemistry; Military Technology; Fatigue (Materials)

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20030062081 Department of the Navy, Washington, DC
Discriminating Speech to Touch Translator Assembly and Method
Belenger, Robert V., Inventor; Lopriore, Gennaro R., Inventor; Nov. 12, 2002; 21 pp.; In English
Patent Info.: Filed 12 Nov. 2002; US-Patent-Appl-SN-10/292953
Report No.(s): AD-D020063; No Copyright; Avail: Defense Technical Information Center (DTIC)
This invention is a speech-to-touch translator assembly and method for converting spoken words directed at an operator into tactile sensations caused by combinations of pressure point exertions on the body of the operator. Each combination of pressure points exerted signifies a phoneme of one of the spoken words, and sound characteristics superimposed on the spoken words, permitting comprehension of spoken words, and the speaker thereof, by persons who are deaf and blind. (3 figures)
DTIC
Patent Applications; Speech; Translators; Touch

20030062092 NASA Glenn Research Center, Cleveland, OH, USA
Simulating Nonlinear Stator Noise for Active Control
Dyson. R. W.; Hixon, R.; Nallasamy, R. M.; Sawyer, S.; May 2003; 13 pp.; In English; Noise-Con 2003, 23-25 Jun. 2003, Cleveland, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 781-30-09
Report No.(s): NASA/TM-2003-212338; E-13933; NAS 1.15:212338; Copyright; Avail: Other Sources
This paper outlines an idea to achieve this type of active control with on-blade actuators. First, a simple analytical example demonstrates how a simple actuator could be used to nonlinearly control sound. Second, results from a realistic geometry demonstrate high amplitude vortical gusts that produce nonlinear harmonics which can destructively interfere with otherwise unattenuating (propagating) acoustical modes. We focus on the 2BPF acoustic response here to simplify the presentation and to show that nonlinear cancellation is effective on realistic blade rows, but similar simulations for higher frequencies have also been successfully completed.
Author
Active Control; Actuators; Stators; Noise Reduction; Harmonics

20030062154 Naval Surface Warfare Center, Panama City, FL, USA
Acoustic Scattering from Large Aspect Ratio Elastic Targets
Sammelmann, Gary S.; Oct. 2002; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411409; CSS/TR-02/18; No Copyright; Avail: CASI; A05, Hardcopy
This paper applies the spheroidal T-matrix approach of Dr. Roger H Hackman described in his paper 'The Transition Matrix for Acoustic and Elastic Wave Scattering in Prolate Spheroidal Coordinates', Journal of the Acoustic Society of America, 75(1), PP. 35-45 to describe the scattering from large aspect ratio targets. Due to the limits of double precision arithmetic in the computation of the spheroidal wave functions, these methods are limited to frequencies below KL/2 = 30.
DTIC
Acoustic Scattering; Elastic Waves; Wave Scattering; Matrices (Mathematics)

20030062751 Defence Science and Technology Organisation, Victoria, Australia
Scaling of Optical and Low-Megahertz Acoustic Properties of Turbid-Water Systems in the Context of Image Quality
Blair, David G.; Aug. 2002; 42 pp.; In English
Report No.(s): AD-A412135; DSTO-TN-0419; DODA-AR-012-296; No Copyright; Avail: CASI; A03, Hardcopy
In the context of underwater imaging of minelike objects, it is desired to compare the quality of acoustic images with that

of optical images at various turbidity levels. For this purpose, there has been interest in scaling experiments to a smaller size. First it is shown that, when modelling a target at range si (e.g 5 metres), by experimenting at a shortened range I (e.g. 1 metre), one must (at l) use a different concentration of added matter for the acoustic than for the optical measurements. This effect arises because the acoustic attenuation that occurs in clear water is a constant and is not to be scaled. The report derives, first, the appropriate modified scaling laws, and second, the laws for maintaining constant image quality, on which the former laws depend. Because the image quality depends on the signal-to-noise ratio in the image, the latter laws depend on the properties of the acoustic noise. The laws of constant quality are derived for three noise environments: instrumentation noise, clutter and the combination of the two. Methods of carrying out the scaling experiment are described. Unfortunately the main conclusion is negative: the real noise is such that scaling experiments in the acoustic mine imaging context are not possible in practice. Here the problem for the first noise environment is that two assumptions are made that do not hold in the normal experimental arrangement; for the second and third environments, an acoustic array of reduced size would have td be built at prohibitive cost. Formulae for the visibility range are given.
DTIC
Signal To Noise Ratios; Acoustic Imaging

20030062947 Department of the Navy, Washington, DC
Sonar Transducer with Tuning Plate and Tuning Fluid
Mapes, Theodore J., Inventor; Dec. 9, 2002; 18 pp.; In English
Patent Info.: Filed 9 Dec. 2002; US-Patent-Appl-SN-10244922
Report No.(s): AD-D020060; No Copyright; Avail: Other Sources

A method for maximizing the radiated power of a transducer, such as a sonar transducer, includes providing a transducer system comprising a transducer operating at a frequency f and having a radiating face, a tuning fluid having a density rho(sub 1) and a speed of sound c(sub 1) a tuning plate having a density rho(sub p) and a thickness t, and an external fluid having a density rho(sub 2) and a speed of sound c(sub)2; and tuning the transducer to have a maximum. specific acoustic resistance at the radiating face in accordance with the equation: (2PI F RHO(SUB P)T)SQUARED/RHO(SUB 2) C(SUB 2) RHO (SUB 1) C(SUB 1) PLUS RHO(SUB 1) C(SUB 1)/RHO(SUB 2 C(SUB 2)rho(sub 1) c(sub 1). The present invention also relates to changing the resonance frequency of a transducer including providing a transducer system with an operating frequency f, the tuning plate spaced from the transducer face by a distance S, and the. tuning fluid between the transducer face and the tuning plate and changing the resonance frequency in accordance with the equation rho(sub 1) c(sub 1) cot(2 pi f s/c(sub 1)).
DTIC
Transducers; Tuning; Radiation Tolerance; Sonar; Acoustic Velocity

20030063018 NASA Langley Research Center, Hampton, VA, USA
Active/Passive Control of Sound Radiation from Panels using Constrained Layer Damping
Gibbs, Gary P.; Cabell, Randolph H.; [2003]; 8 pp.; In English; 11th AIAA/ASME/AHS Adaptive Structures Conference, 7-10 Apr. 2003, Norfolk, VA, USA
Report No.(s): AIAA Paper 2003-1813; No Copyright; Avail: CASI; A02, Hardcopy

A hybrid passive/active noise control system utilizing constrained layer damping and model predictive feedback control is presented. This system is used to control the sound radiation of panels due to broadband disturbances. To facilitate the hybrid system design, a methodology for placement of constrained layer damping which targets selected modes based on their relative radiated sound power is developed. The placement methodology is utilized to determine two constrained layer damping configurations for experimental evaluation of a hybrid system. The first configuration targets the (4,1) panel mode which is not controllable by the piezoelectric control actuator, and the (2,3) and (5,2) panel modes. The second configuration targets the (1,1) and (3,1) modes. The experimental results demonstrate the improved reduction of radiated sound power using the hybrid passive/active control system as compared to the active control system alone.
Author
Noise Reduction; Active Control; Feedback Control; Systems Engineering; Sound Waves; Damping

20030063028 Osaka Univ., Japan
Blood Flow Visualization in Immersive Environment Based on Color Doppler Images
Imura, M.; Kuroda, T.; Oshiro, O.; Chihara, K.; Brandberg, J.; Ask, P.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412090; No Copyright; Avail: CASI; A01, Hardcopy

An accurate grasp of blood flow patterns in a human heart is important to evaluate cardiac diseases of patients. Doppler ultrasound method is widely used to visualize blood flow patterns and has obtained excellent results in diagnosis. However, the output from Doppler ultrasound method is usually represented as a two-dimensional image, though blood flow patterns have three-dimensional complex structure and change dynamically. Therefore, improvement of both data acquisition and data visualization techniques is indispensable to diagnosis of cardiac faculty. It is worth mentioning that visualization also dominates the level of understanding as data acquisition, because poor visualization ruins the value of the most accurate result of measurement as if it were nothing. The authors construct an interactive visualization system suitable for three-dimensional blood flow, utilizing the immersive projection display. With the developed visualization system, which possesses interactivity and a wide field of view, users can easily understand the state of entire flow, such as the occurrence of turbulence, and the patterns of blood flow.
DTIC
Flow Visualization; Blood Circulation; Visual Observation

20030063054 Minnesota Univ., Minneapolis, MN, USA
Enhanced Lesion Visualization in Image-Guided Noninvasive Surgery With Ultrasound Phased Arrays
Yao, Hui; Phukpattaranont, Pornchai; Ebbini, Emad S.; Oct. 25, 2001; 5 pp.; In English
Report No.(s): AD-A411470; No Copyright; Avail: CASI; A01, Hardcopy

We describe dual-mode ultrasound phased arrays for noninvasive image-guided surgical applications. in particular, we address the problem of real-time visualization of thermal lesion formation in the target (e.g., tumor) tissue using the therapeutic arrays. Post beamforming filter bank image reconstruction with nonlinear compounding is utilized to improve the lesion contrast in the (typically) very low-contrast ultrasound images. It is shown that the new image reconstruction algorithm leads to measurable improvement in lesion contrast on the order of 6-15 dB. This leads to significant improvement in lesion detectability and size estimation by standard segmen tation techniques for speckle imagery Experimental results strongly suggest that 2nd Harmonic imaging could play an important role in the enhancement of real-time lesion visualization.
DTIC
Transducers; Phased Arrays; Lesions; Image Reconstruction

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20030062067 Southeast Univ., Nanjing, China
Using Biomedical Sensor-Reflectometry Interference Spectroscopy for Evaluation of Biocompatibility of Biomaterials
Xiaoying, Lu; Huifen, Huang; Yan, Huang; Weiping, Qian; Chunwei, Yuan; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412094; No Copyright; Avail: CASI; A01, Hardcopy

Using a biomedical sensor setup RIfS we have investigated the kinetic behavior of bovine serum albumin (BSA), human fibrinogen (FIb) and human IgG adsorbed onto surfaces of hydroxyapatite (HA) and polyurethane (PU) H50-50. According to the operation principle of RifS and the molecular dimensions of three kinds of proteins, a formula to calculate the adsorbed layers of proteins onto the surface of HA and PU H50-50 has been introduced. The results show that the adsorbed layers of three kinds of proteins on the surface of HA are 1. 0751 for IgG, 0.9684 for BSA, 0.7464 for FIb and that of PU H50-50 are: 0.8199 for IgG, 0.7964 for BSA, 0.6120 for FIb. It is shown that RIfS can perform a kinetic, real time and in situ analysis of plasma proteins adsorbed on a surface of biomaterials. From this study the potential application of RIfS as a new analytical tool in the evaluation of the biocompatibility of biomaterials was confirmed and the experiences of preparing the suitable nanograde film from in-and organic biomaterials for a RIfS experiment were accumulated.
DTIC
Spectroscopy; Adsorption; Proteins

20030062085 NASA Marshall Space Flight Center, Huntsville, AL, USA
Hot Views on Cold Crystals: The Application of Thermal Imaging in Cryocrystallography
Snell, Eddie; [2003]; 1 pp.; In English; Phoenix Camera Working Group Meeting, 7-9 May 2003, Oak Ridge, TN, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

We have used thermal imaging techniques to visualize the cryocooling processes of macromolecular crystals. Cryocooling is a common technique used for structural data collection to reduce radiation damage in intense X-ray beams and decrease the thermal motion of the atoms. From the thermal images it was clear that during cryocooling a cold wave progresses through a crystal starting at the face closest to the origin of the cold stream and ending at the point furthest away. As an extension to this work, we used thermal imaging to study small crystals, held in a cryo-loop, in the presence of vitrified mother liquor. The different infrared transmission and reflectance properties of the crystal in comparison to the mother liquor surrounding it are thought to be the parameter that produces the contrast that makes the crystal visible. An application of this technology may be the determination of the exact location of small crystals in a cryo-loop for automated structural genomics studies. Data from initial tests in support of application development was recorded for lysozyme crystals and for bFGF/dna complex crystals, which were cryocooled and imaged in large loops, both with visible light and with infrared radiation. The crystals were clearly distinguished from the vitrified solution in the infrared spectrum, while in the case of the bFGF/dna complex the illumination had to be carefully manipulated to make the crystal visible in the visible spectrum. These results suggest that the thermal imaging may be more sensitive than visual imaging for automated location of small crystals. However, further work on small crystals robotically mounted at SSRL did not clearly visualize those crystals. The depth of field of the camera proved to be limiting and a different cooling geometry was used, compared to the previous, successful experiments. Analysis to exploit multiple images to improve depth of field and experimental work to understand cooling geometry effects is ongoing. These results will be presented along with advantages and disadvantages of the technique and a discussion of how it might be applied.
Author
Cryogenic Cooling; Imaging Techniques; Thermal Mapping; Deoxyribonucleic Acid; Infrared Radiation; Crystals

20030062195 NASA Glenn Research Center, Cleveland, OH, USA
Atomic Oxygen Effects on Spacecraft Materials
Banks, Bruce A.; Miller, Sharon K. R.; deGroh, Kim K.; Demko, Rikako; June 2003; 12 pp.; In English; Ninth International Symposium on Materials in a Space Environment, 16-20 Jun. 2003, Noordwijk, Netherlands; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22?755?60?05
Report No.(s): NASA/TM-2003-212484; NAS 1.15:212484; E?14026; No Copyright; Avail: CASI; A03, Hardcopy

Low Earth orbital (LEO) atomic oxygen cannot only erode the external surfaces of polymers on spacecraft, but can cause degradation of surfaces internal to components on the spacecraft where openings to the space environment exist. Although atomic oxygen attack on internal or interior surfaces may not have direct exposure to the LEO atomic oxygen flux, scattered impingement can have can have serious degradation effects where sensitive interior surfaces are present. The effects of atomic oxygen erosion of polymers interior to an aperture on a spacecraft is simulated using Monte Carlo computational techniques. A 2-dimensional model is used to provide quantitative indications of the attenuation of atomic oxygen flux as a function of distance into a parallel walled cavity. The degree of erosion relative is compared between the various interior locations and the external surface of an LEO spacecraft.
Author
Oxygen Atoms; Low Earth Orbits; Erosion; Polymers; Degradation

20030062832 Spectral Sciences, Inc., Burlington, MA, USA
Simulations of Ground and Space-Based Oxygen Atom Experiments
Cline, Jason; Braunstein, Matthew; Minton, Timothy; April 7, 2003; 40 pp.; In English; 9th International Conference on Materials in a Space Environment, 16-20 Jun. 2003, Netherlands
Contract(s)/Grant(s): NAS8-00201; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. SS calculations show multi-collision effect can affect both downstream measurements and flux at surface. 2. Pulsed calculations at nominal source fluxes show that the flux to the surface is close to that expected from theory, but more information is needed. 3. Pulsed calculations needed more resolution to determine whether downstream flux correction is necessary. 4. Higher pulsed fluxes should show multi-collision effects more clearly.
CASI
Oxygen Atoms; Simulation; Surfaces

20030062836 Northwestern Univ., Evanston, IL

Structural Characterization of Artificial Corrosion and Tunnel Junction Barriers Layers

Mirkin, Chad A.; Dec. 2001; 5 pp.; In English

Contract(s)/Grant(s): F49620-98-1-0418; Proj-3484

Report No.(s): AD-A412005; AFRL-SR-AR-TR-03-0060; No Copyright; Avail: CASI; A01, Hardcopy

The goals of the proposed research were to: (1) develop novel Raman-based spectroscopic methods for characterizing corrosion barrier layers prepared from self-assembled monolayers (SAMs); these methods rely on Au colliods as Raman enhancers, and (2) use in situ atomic force microscopy to study the corrosion inhibition effects of organic monolayers on superconductors.

DTIC

Raman Spectra; Corrosion Prevention

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20030062199 NASA Marshall Space Flight Center, Huntsville, AL, USA

Thermally Simulated Testing of a Direct-Drive Gas-Cooled Nuclear Reactor

Godfroy, Thomas; Bragg-Sitton, Shannon; VanDyke, Melissa; [2003]; 6 pp.; In English; Proceedings of International Congress on Advanced Nuclear Power Plants (ICAPP) 2003, 4-7 May 2003, Cordoba, Spain; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the concept and preliminary component testing of a gas-cooled, UN-fueled, pin-type reactor which uses He/Xe gas that goes directly into a recuperated Brayton system to produce electricity for nuclear electric propulsion. This Direct-Drive Gas-Cooled Reactor (DDG) is designed to be subcritical under water or wet-sand immersion in case of a launch accident. Because the gas-cooled reactor can directly drive the Brayton turbomachinery, it is possible to configure the system such that there are no external surfaces or pressure boundaries that are refractory metal, even though the gas delivered to the turbine is 1144 K. The He/Xe gas mixture is a good heat transport medium when flowing, and a good insulator when stagnant. Judicious use of stagnant cavities as insulating regions allows transport of the 1144-K gas while keeping all external surfaces below 900 K. At this temperature super-alloys (Hastelloy or Inconel) can be used instead of refractory metals. Super-alloys reduce the technology risk because they are easier to fabricate than refractory metals, we have a much more extensive knowledge base on their characteristics, and, because they have a greater resistance to oxidation, system testing is eased. The system is also relatively simple in its design: no additional coolant pumps, heat exchanger, or freeze-thaw systems are required. Key to success of this concept is a good knowledge of the heat transfer between the fuel pins and the gas, as well as the pressure drop through the system. This paper describes preliminary testing to obtain this key information, as well as experience in demonstrating electrical thermal simulation of reactor components and concepts.

Author

Gas Cooled Reactors; Brayton Cycle; Gas Turbine Engines; Nuclear Electric Propulsion; Turbomachinery; Structural Design; Heat Transfer; Systems Engineering

20030062874 College of William and Mary, Newport News, VA, USA

Thomas Jefferson National Accelerator Facility and the Applied Research Center

Wilkerson, Amy; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 315-317; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Jefferson Lab is the youngest of four major basic research facilities in High Energy and Nuclear Physics in the USA, and provides a scientific instrument and research opportunities that are unique in the world. Built, managed, and operated by SURA (Southeastern Universities Research Association) for the Department of Energy, the Thomas Jefferson National Accelerator Facility (Jefferson Lab) makes possible the research of an international user community into how nucleons are built from quarks and gluons, and how this structure leads to the standard nucleon-based picture of the nucleus of ordinary matter. Copious physics data of unprecedented precision are providing new insight into the structure of nucleons and attest to the unique beam quality. The performance of the enabling accelerator technology made Jefferson Lab a key partner in the

construction of the Spallation Neutron Source; and Lab s Free Electron Laser (FEL) and related developments hold high promise beyond science in defense, security, health and manufacturing. Jefferson Lab is a valued contributor to scientific education, and a major resource to the local, regional, and national education community. Our Science Education programs and partnerships are designed to advance science learning at every level and especially to address the urgent need to improve the representation of minorities and women in our nation s science and engineering workforce. Our unique research environment and expertise in science, math, and technology create the basis for extraordinary educational opportunities that are solidly grounded in the Laboratory s scientific programs. Over a third of the Laboratory staff and many of the Lab s scientific users participate as mentors and career role models, interacting on a regular basis with the students and teachers. Jefferson Lab will be holding sessions designed for teachers during NEW 2003. The Applied Research Center or ARC, is the physical location for a unique partnership among Christopher Newport University, the College of William and Mary, Hampton University, Norfolk State University, Old Dominion University and the Department of Energy s Thomas Jefferson National Accelerator Facility (Jefferson Lab). The partnership s goals are 1) to increase the quality of research and education, 2) to investigate complex problems identified by industry; and 3) to stimulate new economic growth and employment. This flagship building, constructed by the City of Newport News Economic Development Authority, marks the start of a 200-acre research park and is a symbol of cooperation and encouragement of local and regional business development. The ARC houses 27 state-of-the art laboratories, office space, computer facilities and a technical library focused on concentrating the region s multidisciplinary materials processing resources. Classroom courses can be taught using distance-learning technologies so students and faculty can stay in the building, minimizing Interruptions to their research. The ARC is also home to high-tech business start-ups, a venture capital firm, and high-tech business support services. The ARC will be providing tours for the participants of NEW 2003.
Author
Research Facilities; High Energy Interactions; Nuclear Physics; University Program; Education; Economic Development

20030063005 Los Alamos National Lab., NM, USA
Capabilities of the WNR High Energy Neutron Beam at LANSCE
Wender, S. A.; Walker, L. S.; Ullmann, J. L.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 343-350; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Weapon Neutron Research facility (WNR) located at the Los Alamos Neutron Scattering Center (LANSCE) is the only facility in the USA with the capability of providing a Time-of-Flight (TOF) measured, un-moderated white neutron spectra from 800 MeV protons on a thin tungsten target. Current beam spot size is limited 10 cm x 10 cm however, the 30 degree right or left flight paths can be modified to provide up to a 100 cm diameter beam spot 30 meters from the target. The LANSCE accelerator also has the capability of using at energies as low as approximately 256 MeV with five different energies per 100 MeV up to 800 MeV. At each different energy, the WNR facility can then bombard a lithium target and produce quasi-mono energetic neutrons thus producing a very wide range of energies. The WNR facility has flight paths at various angles from the tungsten target. These flight paths range from 900 to 15 feet. The more forward flight paths have much harder spectra. The white spectra in these flight paths can then be modified using absorbers to harden the neutron spectra even further. Examples of how the WNR facility can be used to complete health physics measurements will be presented.
Author
Neutron Scattering; Weapons Industry; Research Facilities; Nuclear Physics; Particle Accelerators

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OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20030062065 Swiss Center for Electronics and Microtechnology, Inc., Neuchatel, Switzerland
Wrist-Located Pulse Detection Using IR Signals, Activity and Nonlinear Artifact Cancellation
Renevey, Philippe; Vetter, Rolf; Krauss, Jens; Celka, Patrick; Depeursinge, Yves; 25 Oct. 2001; 5 pp.; In English
Report No.(s): AD-A412092; No Copyright; Avail: CASI; A01, Hardcopy

We present a new integrated device for monitoring heart rate at the wrist using an optical measure. Motion robustness is obtained by using accurate motion reference signals of 3D low noise accelerometers together with dual channel optical sensing. Nonlinear modelling allows to remove the motion contributions in the optical signals and the spatial diversity of the

sensors is used to remove reciprocal contributions in the two channels. Finally a statistical estimation, based on physiological properties of the heart, gives a robust estimation of the heart rate. Qualitative and quantitative performance evaluation of the performances on real signals clearly show that the proposed system gives an accurate estimation of the heart rate, even under intense physical activity.
DTIC
Optical Properties; Infrared Radiation; Nonlinear Systems; Heart Rate

20030062075 Chieti Univ., Chieti Scale, Italy
Study of Raynaud's Phenomenon by Means of Infrared Functional Imaging
Merla, Arcangelo; DiDonato, Luigi; Farina, Giuseppina; Pisarri, Simonetta; Proietti, Michele; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412133; No Copyright; Avail: CASI; A01, Hardcopy

Infrared Functional Imaging was applied to the study of Raynaud's Phenomenon obtaining a simultaneous assessment of the thermal properties of all five fingers of both hands of a group of patients with respect of a control group. The method is based on the use of high-resolution telethermography imaging and allows identification of objective parameters from the re-warming curves of finger immediately after a 2 min cold stress. The evaluation of the area under the temperature versus time curve, namely the temperature integral INT, provides a figure particularly effective in describing the thermal properties of the finger. 18 healthy volunteers, 20 Secondary Scieroderma and 20 Primary Raynaud's Phenomenon patients were studied subsequently to clinical evaluation and nailfold capillaroscopy. This new approach highlighted a quite different behaviour between patients with Primary Raynaud's Phenomenon and those with early diagnosed Systemic Sclerosis This new method, compared with other existing techniques, seems to be useful tool to discriminate between PRP and RP secondary to SSc.
DTIC
Infrared Imagery; Diseases; Cardiovascular System

20030062204 Nanyang Technological Univ., Nanyang, Singapore
Segmentation of Clinical Endoscopic Image Based on Homogeneity and Hue
Tjoa, M. P.; Kirshnan, S. M.; Kugean, C.; Wang, P.; Doraiswami, R.; 25 Oct. 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411771; No Copyright; Avail: CASI; A01, Hardcopy

A computer-assisted endoscopic analysis is intended and facilitates the diagnosis process. Segmentation of the image is an important step and a novel approach is proposed to segment clinical endoscopic images based on homogeneity and color feature hue. In the first stage, the regions are segmented using a peak-finding algorithm on a 2-D histogram of homogeneity and intensity values. In the second stage, histogram analysis of the color feature hue is performed to subdivide the segmented regions obtained from the first stage. The subdivisions of different segmented regions having similar CIE (L* a* b*) color measure are merged. The proposed scheme was evaluated on a database of clinical endoscopic images.
DTIC
Regions; Histograms; Surgical Instruments; Images

20030063060 California Univ Irvine Aeronautics and Fluid Dynamics Laboratories, Irvine, CA, USA
Structure and Modeling of Optical Wavefronts in High-Reynolds-Number Turbulent Aero-Optic Flows
Catrakis, Haris J.; Jan. 27, 2003; 44 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0142
Report No.(s): AD-A411610; AFRL-SR-AR-TR-03-0031; No Copyright; Avail: CASI; A03, Hardcopy

Two new methods have been developed and demonstrated which are particularly useful for modeling the large-scale and small-scale structure of aerooptical distortions, as well as the refractive fluid interfaces or density interfaces responsible for these distortions, at high compressibility and large Reynolds numbers. The first method, termed the interfacial-thickness approach, enables the examination of optical-wavefront propagation in terms of the physical thickness of the refractive interfaces. Demonstration of this method on experimental data in high-compressibility large-Reynolds-number shear layers has revealed that the high-gradient regions are spatially isolated. This observation has been utilized to propose and demonstrate a new modeling approach where the high-gradient interfaces are the dominant elements necessary to reproduce the large-scale optical distortions at high compressibility. The second method enables the characterization of the physical anisotropic structure of aerooptical wavefronts as a function of scale. This is useful to extrapolate the small-scale structure of aerooptical distortions at high compressibility to larger Reynolds numbers. These two new techniques enable the modeling of large-scale and

small-scale aerooptical behavior at high-compressibility flow conditions relevant to high-speed flight. and are important for Air Force applications involving laser beam propagation in high-speed flight such as for tactical fighter aircraft.
DTIC
Optical Properties; Turbulent Flow; Reynolds Number; Wave Front Deformation

20030063182 Kyungpook National Univ., Taegu, Korea, Republic of
Implementation of Gas Sampling Chamber and Measuring Hardware for Capnograph System Considering Thermal Noise Effect and Time Response Characteristics
Park, I. Y.; Lee, S. K.; Park, H. J.; Kang, K. M.; Song, B. S.; Oct. 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A411111; No Copyright; Avail: CASI; A01, Hardcopy

Most capnograph systems that can indirectly determine the partial pressure of carbon dioxide in the blood of a patient are based on NDIR(non-dispersive infrared) absorption technology. As such an NDIR gas analyzing method requires an optical absorption chamber and signal processing hardware. Accordingly, this paper designed and implemented an NDIR type CO2 gas chamber while considering the time response characteristics and lamp chopping frequency. In addition, signal processing hardware using two infrared sources was implemented to reduce the thermal background effect. The gas chamber and signal processing hardware has been tested using temperature variation and human expiration experiment. The results showed that the system could produce a stable output signal and discerning CO2 gas concentration curve similar to a typical capnogram.
DTIC
Gas Analysis; Detection; Infrared Radiation

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030062110 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Self-Consistent Model of the Interacting Ring Current Ions and Electromagnetic Ion Cyclotron Waves, Initial Results: Waves and Precipitating Fluxes
Khazanov, G. V.; Gamayunov, K. V.; Jordanova, V. K.; Krivorutsky, E. N.; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. A6; 9 pp.; In English
Contract(s)/Grant(s): NAG5-6976; NSF ATM-9711381; NSF ATM-9710326; NSF ATM-9800830; Copyright; Avail: CASI; A02, Hardcopy

Initial results from a newly developed model of the interacting ring current ions and ion cyclotron waves are presented. The model is based on the system of two kinetic equations: one equation describes the ring current ion dynamics, and another equation describes wave evolution. The system gives a self-consistent description of the ring current ions and ion cyclotron waves in a quasilinear approach. These equations for the ion phase space distribution function and for the wave power spectral density were solved on aglobal magnetospheric scale undernonsteady state conditions during the 2-5 May 1998 storm. The structure and dynamics of the ring current proton precipitating flux regions and the ion cyclotron wave-active zones during extreme geomagnetic disturbances on 4 May 1998 are presented and discussed in detail.
Author
Mathematical Models; Kinetic Equations; Ion Cyclotron Radiation; Ionization; Plasmas (Physics); Earth Magnetosphere; Plasmasphere; Ion Density (Concentration)

20030062781 North Carolina State Univ., Raleigh, NC, USA
Effect of Temperature Sensitivity and Plasticizer Diffusive Transport on Performance of Layered Solid Propellants under Electrothermal Plasma Injection
Bourham, Mohamed A.; March 29, 2002; 31 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0555
Report No.(s): AD-A412214; ARO-39299.2-EG; No Copyright; Avail: CASI; A03, Hardcopy

The temperature of the propellant's bed may play a role in the burn rates under plasma injection. In this report, a set of experiments was first conducted on the plasma-flow field to determine the spatial and temporal distribution of the plasma temperature, pressure, number density, and velocity. The experiments revealed a decreasing plasma pressure, plasma

temperature, and plasma number density as plasma is leaving the capillary source and expands in air. The plasma jet velocity 2 inches from the source exit was found to be about 1300 m/s. Following characterization of the plasma-flow field, a set of experiments was conducted on JA-2 solid propellant with controlled bed temperature. Experiments, with proposed models, revealed a functional form that includes the bed temperature. Increased burn rates were observed with increased bed temperature, which appears to follow a power law. A model for the burn rate is proposed, which includes the bed temperature and has the burn rate equals A P(a) (T/T ambient)(b). Further investigation of plasma parameters helped to modify the proposed model to include plasma radiative heat flux and plasma number density.
DTIC
Burning Rate; Plasma Jets; Solid Propellants; Beds (Process Engineering)

20030063045 Institute for Scientific Research, USA, Florida Univ., USA, New Era Technology, Inc., Gainesville, FL, USA
Pulsed Magnetic Field Driven Gas Core Reactors for Space Power & Propulsion Applications
Anghaie, Samim; Smith, Blair; Knight, Travis; Butler, Carey; 1 Apr. 2003; 29 pp.; In English; 14th Annual NASA/MSFC/JPL Advanced Space Propulsion Workshop, 15-17 Apr. 2003, Huntsville, AL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC8-225; Copyright; Avail: CASI; A03, Hardcopy

The present results indicated that: 1. A pulsed magnetic driven fission power concept, PMD-GCR is developed for closed (NER) and semi-open (NTR) operations. 2. In power mode, power is generated at alpha less than 1 for power levels of hundreds of KW or higher 3. IN semi open NTR mode, PMD-GCR generates thrust at I(sub sp) approx. 5,000 s and jet power approx. 5KW/Kg. 4. PMD-GCR is highly subcritical and is actively driven to critically. 5. Parallel path with fusion R&D needs in many areas including magnet and plasma.
Derived from text
Magnetic Fields; Pulse Rate; Reactor Cores

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SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20030062104 NASA Marshall Space Flight Center, Huntsville, AL, USA
Physics of Biocrystals and Their Growth
Chernov, A.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

Recent results on binding between protein molecules in crystal lattice, crystal-solution surface energy, elastic properties and strength and spontaneous crystal cracking are reviewed and discussed in the first half of the paper (Sections 2-5). In the second part, some basic approaches to solubility of proteins is followed by overview on crystal nucleation and growth (Section 6). It is argued that variability of mixing in batch crystallization may be a source scattering of crystal number ultimately appearing in the batch (Section 7). Frequency at which new molecules join crystal lattice is related to the observable crystal growth rate. Numerical criteria to discriminate diffusion and kinetic limited growth are discussed on this basis in Section 8. In Section 9, creation of defects is discussed with the emphasis on the role of impurities and convection in macromolecular crystal perfection.
Author
Crystal Growth; Proteins; Crystal Lattices; Surface Energy; Elastic Properties; Cracking (Fracturing)

20030062117 NASA Marshall Space Flight Center, Huntsville, AL, USA
Structural Basis for Flip-Flop Action of Thiamin-Dependent Enzymes Revealed by Crystal Structure of Human Pyruvate Dehydrogenase
Ciszak, Ewa; Korotchkina, Lioubov G.; Dominiak, Paulina M.; Sidhu, Sukdeep; Patel, Mulchand S.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The biologically active derivative of vitamin B1; thiamin pyrophosphate; is used as cofactor by many enzymes that perform a wide range of catalytic functions in the pathways of energy production. In alpha2beta2-heterotetrameric human pyruvate dehydrogenase, the first catalytic component enzyme of human pyruvate dehydrogenase complex, this cofactor is used to cleave the C(sup alpha)-C(=0) bond of pyruvate followed by reductive acetyl transfer to lipoyl-dihydrolipoamide acetyltransferase, the second catalytic component of the complex. The dynamic nonequivalence of two, otherwise chemically

equivalent, catalytic sites have puzzled researchers from earlier functional studies of this enzyme. In order to gain insight into the mechanism of action of this enzyme, we determined the crystal structure of the holoform of human pyruvate dehydrogenase at 1.958, resolution. We propose a kinetic model for the flip-flop action of this enzyme through the concerted approx. 2A, shuttle-like motion of the heterodimers. The similarity of thiamin pyrophosphate binding in human pyruvate dehydrogenase and other functionally related enzymes suggests this newly defined mechanism of shuttle-like motion of domains to be common for the family of thiamin pyrophosphate-dependent enzymes.
Author
Thiamine; Pyruvates; Enzymes; Phosphates; Crystal Structure

20030062127 NASA Marshall Space Flight Center, Huntsville, AL, USA
Critical Behavior at the L-L Phase Transition of Lysozyme Protein Solutions
Gorti, Sridhar; Forsythe, Elizabeth; Laxson, Nicole; Pusey, Marc; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Recent efforts suggest the possibility that crystallization, and liquid-liquid (L-L) phase transitions and critical phenomena are characteristics universal to all macromolecular solutions. Of particular interest to protein crystallographers are the predictions of a critical slowing of crystal growth and subsequent formation of nascent crystals at the L-L phase boundary. Herein, the effects of the L-L phase transition on both crystal growth rates and microcrystal formation are experimentally determined. In general, it was determined that critical slowing down of protein crystal growth rates occurred, as predicted. The L-L phase transition, however, had a net negative influence in the formation of nascent protein crystals. Although crystal nucleation was not induced by the L-L phase transition, it is considered that the phase behavior of macromolecular solutions can be universally defined.
Author
Phase Transformations; Protein Crystal Growth; Lysozyme; Solutions

20030062198 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solutal Convection Around Growing Protein Crystal and Diffusional Purification in Space
Chernov, A. A.; Lee, C. P.; [2002]; 1 pp.; In English; International Symposium on Physical Sciences in Space, 4-8 May 2003, Toronto, Canada; No Copyright; Avail: Other Sources; Abstract Only

This work theoretically addressed two subjects: 1) onset of convection, 2) distribution of impurities. Onset of convection was considered analytically and numerically. Crystal growth was characterized by slow surface incorporation kinetics, i.e. growth kinetic coefficient beta (cm/s) small as compared to the typical bulk diffusion rate, D(sub 1)/h, where D(sub 1) is diffusivity of major crystallizing protein and h is the crystal size. Scaling type analysis predicted two laws on how the convection rate, v, essentially the Peclet number, Pe exactly equal to vh/D(sub 1), depends on dimensionless kinetic coefficient a exactly equal to beta h/D(sub 1). Namely: Pe = C(sub 2/5)(aRa(sup 2/5)) and Pe = C(sub 1) aRa. Here, Reynolds number Ra = rho(sub 1)(sup 0)gh(sup 3)(rho(sub p) - rho(sub w))/rho(sup p)rho(sub 1)vD(sub 1), v being solution viscosity. The constants C(sub 2/5), exactly equal to 0.28 and C(sub 1) exactly equal to 10(exp -2) found from the full scale computer simulation for a cylindrical crystal inside big cylindrical vessel. The linear boundary conditions connecting protein and impurity concentration at the interface with the flux to/from the interface was applied. No-slip condition for Navier-Shocker equations was employed. With these conditions, flow and concentration distributions were calculated. Validity of the Pe(Ra) dependencies follows for wide range of parameters for which numerical calculations have been accomplished and presented by various points.
Derived from text
Protein Crystal Growth; Solutions; Convection; Diffusion; Impurities

20030062848 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
The Use of Piezoelectric Materials in Smart Structures
Pai, Devdas M.; Sundaresan, Naresh R.; Cadenhead, Natasha; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 213-220; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This paper reports on a fairly inexpensive test setup to expose students to a very sophisticated new generation of smart materials. Students are able to measure micro-timescale physical events and calculate meaningful values for physical

properties and relate them to analytical quantities. Further, the nature of the experiment allows for generation of data by individual students and further statistical analysis of class data.
Derived from text
Piezoelectricity; Smart Structures; Ultrasonic Radiation; Statistical Analysis; Physical Properties

20030062979 NASA Marshall Space Flight Center, Huntsville, AL, USA
Examination of Short- and Long-Range Atomic Order Nanocrystalline SiC and Diamond by Powder Diffraction Methods
Palosz, B.; Grzanka, E.; Stelmakh, S.; Gierlotka, S.; Weber, H.-P.; Proffen, T.; Palosz, W.; [2002]; 1 pp.; In English; 225th American Chemical Society Meeting, 23-27 Mar. 2003, New Orleans, LA, USA; Copyright; Avail: Other Sources; Abstract Only

The real atomic structure of nanocrystals determines unique, key properties of the materials. Determination of the structure presents a challenge due to inherent limitations of standard powder diffraction techniques when applied to nanocrystals. Alternate methodology of the structural analysis of nanocrystals (several nanometers in size) based on Bragg-like scattering and called the 'apparent lattice parameter' (alp) is proposed. Application of the alp methodology to examination of the core-shell model of nanocrystals will be presented. The results of application of the alp method to structural analysis of several nanopowders were complemented by those obtained by determination of the Atomic Pair Distribution Function, PDF. Based on synchrotron and neutron diffraction data measured in a large diffraction vector of up to Q = 25 Angstroms(exp -1), the surface stresses in nanocrystalline diamond and SiC were evaluated.
Author
Nanocrystals; Silicon Carbides; Powder (Particles); Neutron Diffraction; Structural Analysis; Atomic Structure; Diamonds

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20030062995 Mitsubishi Research Inst., Inc., Tokyo, Japan
Radiation Weighting Factors for High Energy Neutron, Proton, and Alpha Particles
Yoshizawa, N.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 377-385; In English; See also 20030062989; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Traditionally, radiation protection has relied on radiation dependent modifying factor Q(L) based on linear energy transfer L of the local tissue charged particle environment. In 1991, the International Commission on Radiological Protection (ICRP, Report Number 60) recommended a nonlocal exposure field quantity Wr to emphasize the uncertainties in knowledge of the appropriate modifying factor. The use of Wr simplifies dosimetry in many field applications but complicates the evaluation using some computational procedures. An alternate quantity has been defined by the International Commission on Radiological Units (ICRU, Report Number 51) as organ dose equivalent calculated in the traditional way using Q(L). Exceptions to the ICRP recommended Wr for protons has been made by the National Council on Radiation Protection and Measures (NCRP Report Number 116) on the basis of organ dose equivalent. The present paper will fully address these issues and provide conversion factors for relavant radiation for any of the evaluation systems.
Author
Alpha Particles; Neutrons; Protons; Radiation Protection; Radiology

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20030062767 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Regional Monitoring and Visualization System for Decision Support and Disaster Management Applications for the Mesoamerican Biological Corridor and Beyond
Irwin, Daniel; [2002]; 1 pp.; In English; Central American Commission for Environment and Development Donors Conference on the Mesoamerican Biological Corridor, 12 Dec. 2002, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

The Mesoamerican Biological Corridor (MBC)-a network of managed and protected areas extending from Mexico to Columbia-is a crucial initiative for the Mesoamerican region, with a central development concept of integrating conservation and sustainable use of biodiversity within the framework of sustainable economic development. The MBC is of particular importance to the Central American Commission for Environment and Development (CCAD), which is comprised of the environmental ministers from the seven Central American countries. Responsible for determining priority areas for action in the corridor, CCAD decision makers require current and accurate information, and access to the dynamic knowledge of the changes in the MBC such as deforestation hotspots, fires, and the effects of natural disasters. Currently this information is not integrated and in disparate locations throughout the region and the world. Leveraging NASA technology, satellite data, and capability, we propose to team with the World Bank and the CCAD to develop a regional monitoring and visualization system-with central nodes at the NASA/Marshall Space Flight Center and at CCAD headquarters. This system will assimilate NASA spatial datasets (e.g. MODIS, Landsat, etc.), spatial data from other sources (commercial and public-domain), and ancillary data developed in each of the seven Central American countries (soils, transportation networks, biodiversity indicator maps, etc.). The system will function as a 'virtual dashboard' for monitoring the MBC and provide the critical decision support tools for CCAD decision makers. The CCAD central node will also serve as a high-tech showcase for the corridor among the international community, other decision-makers, the media, and students.

Author

Disasters; Economic Development; Biological Diversity; Conservation; Deforestation

20030062849 Edmonds Community Coll., Lynnwood, WA, USA

Attention-Getting Materials Science Demonstrations

Rusin, John M.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 233-238; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

In the Materials Science & Technology (MST) teacher training workshops and institutes conducted by the NSF Enhancement of Materials Technology for Manufacturing (EMTECH) program at Edmonds Community College we use several quick, attention-getting demonstrations that teachers can use to 'hook' their students. Most of the activities have been picked up from other sources including the MST master teachers in our program.

Author

Education; Students; Instructors; Materials Science

20030062882 Edmonds Community Coll., Lynnwood, WA, USA

Status of Materials Science and Technology (MST) Curriculum

Rusin, John M.; Stoebe, Thomas G.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 227-231; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Materials Science and Technology (MST) are topics that excite students' interest because the student has everyday, hands-on experience with materials. Thus materials topics are great motivators in any engineering, technology or science course. Materials Science activities can also be used in both academic and vocational courses and thus assist in the transition for technology students across the high school-community college boundary. Several institutions have developed MST activities and curriculum with support from the Department of Energy, the National Science Foundation, and other agencies. MST classes are currently being offered in several high schools throughout the U.S.. Students obtain either science or technology credit for the class. MST curriculum has been aligned with National Science, Math, and Technology Standards and some state standards such as the Washington (State) Essential Academic Learning Requirements. MST teacher training is currently offered by the NSF DUE/ATE Enhancement of Materials Technology for Manufacturing (EMTECH) program located at Edmonds Community College in Lynnwood, WA. EMTECH conducts workshops and institutes at several sites located throughout the U.S.

Author

Materials Science; Technologies; Education; Students; Schools

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030062060 NASA Marshall Space Flight Center, Huntsville, AL, USA
Commercial Research Results from the International Space Station
Nall, Mark; [2003]; 1 pp.; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2003, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

As part of NASA's mission of enabling commercial opportunities in space, the Space Product Development Office has sponsored the flight of twelve commercial payloads to the International Space Station (ISS) during calendar year 2002. These twelve follow seven commercial payloads flown to the ISS during 2001. Many of these payloads, which were among the first users of this new laboratory, built upon successful commercial investigations that previously were restricted to the limited flight duration of the Space Shuttle. While the majority of early commercial use of the ISS is in the area of biotechnology, there is a significant shift towards commercial materials research over the next two years. New commercial payloads such as Space-DRUMS and Vulcan will advance commercial materials research on the ISS. Commercial flight hardware is available to the broader NASA community in order to provide benefit to the entire NASA microgravity program, and the scientific community on a space available basis and at very low cost. The first commercial operations on the ISS provides not only a needed capability to the commercial development of space program, it will also augment the science program as well. Author

Space Commercialization; International Space Station; Space Shuttle Payloads; Product Development; Technology Transfer

20030062114 NASA Marshall Space Flight Center, Huntsville, AL, USA
Government and Industry Issues for Expanding Commercial Markets into Space
Smitherman, David V., Jr.; [2003]; 8 pp.; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, USA; Copyright; Avail: CASI; A02, Hardcopy

In 2002, the Foresight and Governance Project at the Woodrow Wilson Center in Washington, D.C, organized a 'Global Foresight Workshop' in partnership with NASA and in cooperation with other Federal Agencies to provide integrated consideration of broad challenges for the 2lst century. Many long-range goals for the nation were discussed and selected, among them were space related goals of interest to NASA. During much of the Agency's history, NASA advanced studies have focused consistently on the challenges of science-driven space exploration and operations. However, workshop findings indicate little interest in these goals unless they can also solve national and global issues. Many technologies and space development studies indicate great potential to enable new, important commercial markets in space that could address the many global challenges facing America in this century. But communication of these ideas are lacking. In conclusion, it appears that the commercial development of space could have broad implications on many impending problems, including energy resources, environmental impact, and climate changes. The challenge will be to develop a consistent coordinated effort among the many industries and Agencies that should be involved in opening this new frontier for these new commercial markets. Author

Environmental Surveys; Space Commercialization; Space Exploration; Goals

20030062873 Hess (Kenneth Lafferty) Foundation, Carmel, CA, USA
Science Buddies
Han, Gina; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 511-513; In English; See also 20030062842; No Copyright; Avail: CASI; A01, Hardcopy

Science Buddies is a peer e-mentoring program for Bay Area middle and high school students with a fun, hands-on approach to science and access to science-related career role models. The goal is for students to complete a science fair project and to enter it in a local science fair. How Science Buddies is unique: 1.PEER mentoring: Students help other students. High school Mentors are trained to take the lead in guiding the less experienced student who does the actual project. The team Advisor (usually a science professional) serves as backup and sometimes takes a more active role when necessary. 2. CONVENIENT e-mentoring: All team interaction takes place via an online, message board monitored by Science Buddies staff. Check in anytime, anywhere there s Internet access. 3. FRAMEWORKED: The interactive Web site leads students through a step-by-step project framework, places how-to information at their fingertips, and provides samples. Each Advisor is matched with a student team (a middle school and a high school Mentor) interested in the Advisor s area. The Advisor helps them refine a topic suitable to their skill level that leverages the Advisor s background. What Science Buddies looks for in

Advisors: 1. Desire to foster interest in the sciences at a pivotal age. 2.Wish to give back to the community in a way that does not take a lot of time but has high value. 3. Has a science or engineering background by education and/or profession. 4. Accesses the Internet and email on a regular basis.
Author
Education; Students; Websites

20030062958 NASA Ames Research Center, Moffett Field, CA, USA
How do we Remain Us in a Time of Change: Culture and Knowledge Management at NASA
Linde, Charlotte; [2003]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph representation presents an overview of findings of a NASA agency-wide Knowledge Management Team considering culture and knowledge management issues at the agency. Specific issues identified by the team include: (1) NASA must move from being a knowledge hoarding culture to a knowledge sharing culture; (2) NASA must move from being center focused to being Agency focused; (3) NASA must capture the knowledge of a departing workforce. Topics considered include: what must NASA know to remain NASA, what were previous forms of knowledge reproduction and how has technological innovations changed these systems, and what changes in funding and relationships between contractors and NASA affected knowledge reproduction.
CASI
Information Systems; Knowledge; Management

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20030062772 Army Engineer Research and Development Center, Vicksburg, MS, USA
Primer: Using Watershed Modeling System (WMS) for Gridded Surface Subsurface Hydrologic Analysis (GSSHA) Data Development - WMS 6.1 and GSSHA 1. 43C
Downer, Charles W.; Nelson, E. J.; Byrd, Aaron; [2003]; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A412251; ERDC/CHL-TR-03-2; No Copyright; Avail: CASI; A05, Hardcopy

This document is a primer for use of the Watershed Modeling System (WMS) interface with the physically based, distributed-parameter hydrologic model Gridded Surface Subsurface Hydrologic Analysis (GSSHA). The primary purpose of this primer is to describe how the WMS interface is used to develop inputs and analyze output from the GSSHA model. This primer also provides a brief description of the GSSHA model including the overall model formulation, processes that can be simulated, and input formats for files not supported by WMS. Along with the WMS 'how-to' information, the primer provides hints on appropriate values to use in a GSSHA simulation, potential problem areas, and trouble shooting suggestions. However, this primer is not meant to be a substitute for the GSSHA User's Manual, which should be consulted for specific information on the GSSHA model. Many of the concepts used in the GSSHA model are complex, and an in-depth knowledge of the processes involved and the solution methods available are critical for successful application of the model. It is highly recommended that users obtain and read the GSSHA User's Manual before attempting to use the GSSHA model. In addition, many of the procedures outlined in this primer are described in greater detail in the WMS Help File. User's should be aware that the GSSHA model is always in development and is constantly being improved, refined, and updated with new ideas. Typically, linkage with the WMS interface is the last task completed in new model developments, after development, implementation, and testing of the new feature in GSSHA are complete. Therefore, WMS may not support new developments in the GSSHA model. Some files that the GSSHA model uses, such as the rainfall and hydrometeorological data files for long-term simulations, are not supported by the WMS interface. Files that WMS does not support are pointed out in the primer and also in the User's Manual.
DTIC
Mathematical Models; Hydrology; Primers; Watersheds

20030062821 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
Integrated Global Positioning Systems (GPS) Laboratory
Brown, Dewayne Randolph; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 21-28; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this research is to develop a user-friendly Integrated GPS lab manual. This manual will help range engineers at NASA to integrate the use of GPS Simulators, GPS receivers, computers, MATLAB software, FUGAWI software and SATELLITE TOOL KIT software. The lab manual will be used in an effort to help NASA engineers predict GPS Coverage of planned operations and analyze GPS coverage of operation post mission. The Integrated GPS Laboratory was used to do GPS Coverage for two extensive case studies. The first scenario was an airplane trajectory in which an aircraft flew from Cape Canaveral to Los Angeles, California. In the second scenario, a rocket trajectory was done whereas a rocket was launched from Cape Canaveral to one thousand kilometers due east in the Atlantic Ocean.
Author
Computer Programs; Kits; Global Positioning System; Manuals

20030062859 Norfolk State Univ., VA, USA
MST-Online: The Updating of an Educational Internet Resource in Materials Science and Technology
Harris, Nikki; Wall, Curtiss E.; Jacobs, James A.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 199-202; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

MST-Online continues to provide students and educators with opportunities to learn more about materials technology and provide useful links, vibrant images, and informative resources. In order to better meet the needs of educators and students MST- Online is continuously being updated. We are adding animation created through Macromedia Flash MX and images provided by NASA Langley Research Center. Animations will be influenced by the Centennial of Flight, profile various airplanes, and other activities that occur at NASA Langley Research Center. By using animation, MST-Online hopes to provide students and others with an understanding of the activities and tasks that are involved with materials technology.
Derived from text
Education; Materials Science; Internet Resources; On-Line Systems

20030062896 ENGINEER RESEARCH AND DEVELOPMENT CENTER CHAMPAIGN IL, Champaign, IL, USA
Hazardous Materials Information Network (HAZMIN) Software Conversion Study
Baird, Joyce C.; Mullaney, Joe; Schiller, Don; Wager, Gary; Nov. 2002; 66 pp.; In English
Report No.(s): AD-A411874; ERDC/CERL-TR-02-29; No Copyright; Avail: CASI; A04, Hardcopy

The U.S. Army's Watervliet Arsenal (WVA) in New York is faced with increasing environmental regulation and reduced manpower to meet regulatory requirements. The main task of this project was to update an existing software-based hazardous material tracking software application. The objective of this task was to increase the Environmental Management Information System (EMIS) capabilities to allow hazardous material control, tracking, and reporting. Another main objective was to improve users' right-to-know about potential hazardous material hazards. EMIS is used to centralize, automate, and manage the acquisition, flow, storage, and reporting of environmental information throughout the Arsenal. After installation, the new time saving and paperwork reduction for the administration and distribution of the MSDSs are significant. In addition, the risk exposure to the Arsenal due to uncontrolled substances being issued and used, duplicate amounts being stored at various localities on site, and general lack of tracking of hazardous substances is greatly reduced. The rapid and user friendly procedures that are used to control the issuance of the materials by way of committee member e-mail capabilities is well received by users. The burden of paperwork is reduced, and slate reports are easily generated from the tool kit provided with the upgrade.
DTIC
Computer Programs; Management Information Systems; Hazardous Materials

20030063153 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
A Bibliography of Aspect-Oriented Software Development, Version 1.0
Filman, Robert E.; August 2002; 31 pp.; In English
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-02.06; Copyright; Avail: CASI; A03, Hardcopy

A bibliography of the literature related to Aspect-Oriented Programming. This is meant to be an evolving documents.
Author
Bibliographies; Literature

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20030062056 NASA Marshall Space Flight Center, Huntsville, AL, USA
Weight and the Future of Space Flight Hardware Cost Modeling
Prince, Frank A.; March 31, 2003; 10 pp.; In English; International Society of Parametric Analysis/Society of Cost Estimating and Analysis 2003 International Conference, 17-20 Jun. 2003, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

Weight has been used as the primary input variable for cost estimating almost as long as there have been parametric cost models. While there are good reasons for using weight, serious limitations exist. These limitations have been addressed by multi-variable equations and trend analysis in models such as NAFCOM, PRICE, and SEER; however, these models have not be able to address the significant time lags that can occur between the development of similar space flight hardware systems. These time lags make the cost analyst's job difficult because insufficient data exists to perform trend analysis, and the current set of parametric models are not well suited to accommodating process improvements in space flight hardware design, development, build and test. As a result, people of good faith can have serious disagreement over the cost for new systems. To address these shortcomings, new cost modeling approaches are needed. The most promising approach is process based (sometimes called activity) costing. Developing process based models will require a detailed understanding of the functions required to produce space flight hardware combined with innovative approaches to estimating the necessary resources. Particularly challenging will be the lack of data at the process level. One method for developing a model is to combine notional algorithms with a discrete event simulation and model changes to the total cost as perturbations to the program are introduced. Despite these challenges, the potential benefits are such that efforts should be focused on developing process based cost models.
Author
Mathematical Models; Cost Analysis; Cost Estimates; Airborne/Spaceborne Computers; Spacecraft Electronic Equipment; Weight (Mass)

20030063067 Reading Univ., UK
The Global Airline Company: Agent of Market Power or Competition?
Tolentino, Paz Estrella; Reim, Sabine; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-21; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

The paper seeks to analyze the global airline company in the post-US deregulation era in the context of the two different views of the firm in economic theory. On the one hand, a firm can be regarded as an entity that takes decisions over prices and output and maximizes profits from increasing its degree of market power. Alternatively, the firm can be seen as a device for innovation and knowledge creation and earns higher profits from creating new combinations in production (Schumpeter 1911) or new areas of social or productive capability (Cantwell 2001). While the distinction between the pursuit of profits and profit maximization may have little significance in a sufficiently stable and repetitive decision context, the significance of the distinction increases under conditions of substantial, non-repetitive change (Nelson and Winter 1982). The first view is associated with the neo-classical analysis of the firm, while the second view is linked with classical, Schumpeterian and evolutionary analyses of the firm. The main argument of the paper embodying both theoretical and empirical elements is developed in several stages. The disparate perspectives in the theoretical economics of the firm are analyzed followed by their application to the behavior and competitive position of profitable firms in the global airline industry. The main findings of the study are contained in the concluding section.
Derived from text
Airline Operations; Economics; Commerce; Market Research

20030063070 Hankuk Aviation Univ., Kyunggido, Korea, Republic of
Airport Privatization Policy and Performance Measurement in Korea
Yoo, Kwang Eui; Lee, Yeong-Heok; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-17; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

Korean government is considering the reformation of airport operating system. The objective of the reformation is to improve the economic efficiency related to airport operation. For doing this, it is necessary to know the best practices on various dimensions of airport operations, and it is subsequently required to evaluate the performance of airport operation. This

study is to measure and compare the operating performance of each airport in Korea. In Korea, there are 17 airports opened to civil aviation and these airports offer scheduled flight service. Five of them are able to serve international flights and other twelve airports are for domestic flight service only. The ownership of all those airports belongs to central government. The ministries responsible are the Ministry of Construction and Transportation and the Ministry of National Defense. The autonomous governmental organization, KAA(Korea Airports Authority) is responsible for the operation and management of civil airports without ownership, excluding Incheon International Airport which opened March 2001. The productivity and efficiency, unit costs, and financial status of each airport in the system will be measured and compared. Some interpretations on the results of performance measurement are tried and some recommendations are suggested based on the interpretation of performance indicators of this study.
Author
Airports; Operating Costs; Economics; Workloads (Psychophysiology); Productivity

20030063072 Singapore Univ., Singapore
The Implication of Hub and Spoke Network on the Airline Alliance Strategy
Li, Zou; The Conference Proceedings of the 2001 Air Transport Research Society (ATRS) of the WCTR Society, Volume 3; July 2001, pp. 1-44; In English; See also 20030063064; Copyright; Avail: CASI; A03, Hardcopy

The structure of an airline's network plays an important role in the development of airline's strategy. In this paper, a theoretical model supposing two airlines hub and spoke networks investigates the effects of different strategies on the airlines' outputs, profits and economic welfare. The model simulates the market results of two profit-maximizing airlines under the basic form of bilateral agreement, the partial alliance and the complete alliance. It is found that firstly, the basic bilateral agreement, which combines the two airlines separate networks, stimulates more local and connecting traffic. Passengers are better off for the increased service as well as the reduced airfare. The profits for both airlines increase after the agreement for the extensive network and the economies of traffic density. Consequently, the basic form of the bilateral agreement definitely improves the economic welfare. Secondly, under the background of the bilateral agreement, two airlines make partial alliance by which they jointly offer the inter- hubbing flights. After the alliance, the output between the hub cities decreases, while the flights on the local and connecting markets increase for both airlines. Though passengers are worse off on the inter-hubbing market, they benefit from the increase of service and the decrease of airfare on other markets. As market size gets larger, the gains to passengers become high enough to compensate for the losses to them. Therefore, consumer surplus increases for the partial alliance. Furthermore it is shown that the total profits of the two airlines increase for the partial alliance and the increase of the profits gets larger as the market size increases. As for the change of economic welfare, it is found that in most conditions, it increases due to the partial alliance. The paper also shows that when increasing return to traffic density is relatively strong, the partial alliance tends to increase the economic welfare at the lower market size. On the other hand, when increasing return to density is relatively weak, the rise of the economic welfare results from the higher value of the market size. Finally, the complete alliance is examined under which the two airlines make the most extensive strategic alliance within their networks as compared to the situation of the open sky bilateral agreement where no alliance exists. The results show that the complete alliance makes the passengers whose flights are within an airline s network better off, but for those passengers on the markets combing the two airlines networks , they are worse off due to the complete alliance. As for the two airlines, their total profits decrease for the complete alliance and the losses get larger as the market size increases. Consequently, the complete alliance makes the economic welfare deteriorate. From these conclusions, some explanation and policy implication are developed.
Author
Airline Operations; Policies; Economics

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20030062172 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Urban Heat Island Phenomenon: How Its Effects Can Influence Environmental Decision Making in Your Community
Estes, Maurice G., Jr.; Quattrochi, Dale; Stasiak, Elizabeth; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Reinvestment in urban centers is breathing new life into neighborhoods that have been languishing as a result of explosive suburban development over the past several decades. In cities all over the country, adaptive reuse, brownfields redevelopment, transforming urban landscapes, economies, and quality of life. However, the way in which this development occurs has the potential to exacerbate the urban heat island (UHI) phenomenon, an existing problem in many areas and one which poses a threat to the long-term sustainability and environmental quality of cities. The UHI phenomenon is rooted in the science of how the land covers respond to solar heating and can adversely effect the environment. This phenomenon is responsible for urban centers having higher air temperatures and poorer air quality than suburban areas. In addition, the UHI phenomenon causes metrological occurrences, degrades water quality, increases energy demands, poses threats to public health and contributes to global warming. While the name of the phenomenon implies that is solely an urban issue, research has shown that the effects of the UHI are becoming prevalent in suburbs, as well. The UHI phenomenon can plague regions - urban centers and their suburbs. Furthermore, heat islands have been found to exist in both city centers and suburban communities. As suburban areas increasingly develop using land covers and building materials common to urban areas, they are inheriting urban problems - such as heat islands. In this way, it may be necessary for non-urban communities to engage in heat island mitigation. The good news is that through education and planning, the effects of the UHI phenomenon can be prevented and mitigated. Heat islands are more a product of urban design rather than the density of development. Therefore, cities can continue to grow and develop without exacerbating the UHI by employing sustainable development strategies.
Author
Air Quality; Cities; Environmental Quality; Heat Islands; Urban Research

20030062827 Florida Inst. of Tech., FL, USA
Developments in Understanding Stability as Applied to Magnetic Levitated Launch Assist
Gering, James A.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 91-100; In English; See also 20030062814; No Copyright; Avail: CASI; A02, Hardcopy

Magnetic levitation is a promising technology, with the potential of constituting the first stage of a third generation space transportation system. Today, the Space Shuttle burns on the order of one million pounds of solid rocket propellant to bring the orbiter and external tank to nearly Mach 1 (1,000 kph). Imagine the reductions in launch vehicle weight, complexity and risk if an aerospace vehicle could be accelerated to the same speed utilizing about $1,000 of off-board electrical energy stored in flywheels. After over two decades of development, maglev trains travel on full-scale demonstration tracks in Germany and Japan reaching speeds approaching 500 kph. Encouraging as this may appear, the energy and power required to accelerate a 1 million pound launch vehicle to 1,000 kph would radically redefine the state-of-the-art in electrical energy storage and delivery. Reaching such a goal will require levitation with sufficient stability to withstand an operating environment fundamentally different from that of a high-speed train. Recently NASA let contracts for the construction of three maglev demonstration tracks. This construction and several associated trade studies represent a first-order investigation into the feasibility of maglev launch assist. This report provides a review of these efforts, other government sponsored maglev projects and additional technical literature pertinent to maglev stability. This review brings to light details and dimensions of the maglev stability problem which are not found in previous NASA-sponsored trade studies and which must be addressed in order to realize magnetic levitation as a launch assist technology.
Author
Launch Vehicles; Magnetic Suspension; Space Transportation System; Stability; Electrodynamics; NASA Programs

20030062828 University of Central Florida, Orlando, FL, USA
The Virtual Test Bed Project
Rabelo, Luis C.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 119-130; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This is a report of my activities as a NASA Fellow during the summer of 2002 at the NASA Kennedy Space Center (KSC). The core of these activities is the assigned project: the Virtual Test Bed (VTB) from the Spaceport Engineering and Technology Directorate. The VTB Project has its foundations in the NASA Ames Research Center (ARC) Intelligent Launch & Range Operations program. The objective of the VTB project is to develop a new and unique collaborative computing environment where simulation models can be hosted and integrated in a seamless fashion. This collaborative computing environment will be used to build a Virtual Range as well as a Virtual Spaceport. This project will work as a technology pipeline to research, develop, test and validate R&D efforts against real time operations without interfering with the actual operations or consuming the operational personnel s time. This report will also focus on the systems issues required to

conceptualize and provide form to a systems architecture capable of handling the different demands.
Author
NASA Programs; Virtual Reality; Space Transportation; Systems Engineering; Technology Utilization

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20030062030 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ring Current Ion Coupling with Electromagnetic Ion Cyclotron Waves
Khazanov, George V.; [2002]; 1 pp.; In English; Advanced Research Workshop on the Effects of Space Weather on Technology Infrastructure, 23-30 Mar. 2003, Rhodes, Greece; No Copyright; Avail: Other Sources; Abstract Only

A new ring current global model has been developed for the first time that couples the system of two kinetic equations: one equation describes the ring current (RC) ion dynamic, and another equation describes wave evolution of electromagnetic ion cyclotron waves (EMIC). The coupled model is able to simulate, for the first time self-consistently calculated RC ion kinetic and evolution of EMIC waves that propagate along geomagnetic field lines and reflect from the ionosphere. Ionospheric properties affect the reflection index through the integral Pedersen and Hall coductivities. The structure and dynamics of the ring current proton precipitating flux regions, intensities of EMIC, global RC energy balance, and some other parameters will be studied in detail for the selected geomagnetic storms. The space whether aspects of RC modelling and comparison with the data will also be discussed.
Author
Ring Currents; Kinetic Equations; Ionospheric Propagation; Electromagnetic Radiation; Ion Cyclotron Radiation

20030062094 NASA Marshall Space Flight Center, Huntsville, AL, USA
Hot Views on Cold Crystals: The Application of Thermal Imaging in Cryocrystallography
Snell, Eddie H.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

In the past we have used thermal imaging techniques to visualize the cryocooling processes of macromolecular crystals. From these images it was clear that a cold wave progresses through a crystal starting at the face closest to the origin of the cold stream and ending at the point furthest away. During these studies we used large volume crystals, which were clearly distinguished from the loop holding them. These large crystals, originally grown for neutron diffraction studies, were chosen deliberately to enhance the imaging. As an extension to this work, we used thermal imaging to study small crystals, held in a cryo- loop, in the presence of vitrified mother liquor. The different infrared transmission and reflectance properties of the crystal in comparison to the mother liquor surrounding it are thought to be the parameter that produces the contrast that makes the crystal visible. An application of this technology may be the determination of the exact location of small crystals in a cryo-loop. Data from initial tests in support of application development was recorded for lysozyme crystals and for bFGF/dna complex crystals, which were cryo-cooled and imaged in large loops, both with visible light and with infrared radiation. The crystals were clearly distinguished from the vitrified solution in the infrared spectrum, while in the case of the bFGF/dna complex the illumination had to be carefully manipulated to make the crystal visible in the visible spectrum. These results suggest that the thermal imaging may be more sensitive than visual imaging for automated location of small crystals. However, further work on small crystals robotically mounted at SSRL did not clearly visualize those crystals. The depth of field of the camera proved to be limiting and a different cooling geometry was used, compared to the previous, successful experiments. Analysis to exploit multiple images to improve depth of field and experimental work to understand cooling geometry effects is ongoing. These results will be presented along with advantages and disadvantages of the technique and a discussion of how it might be applied .
Author
Imaging Techniques; Cryogenic Cooling; Crystal Growth

20030062100 NASA Marshall Space Flight Center, Huntsville, AL, USA, Universities Space Research Association, USA, National Academy of Sciences - National Research Council, USA
Finding the Cold Needle in a Warm Haystack: Infrared Imaging Applied to Locating Cryo-cooled Crystals in Loops
Snell, Edward; vanderWoerd, Mark; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

Thermally imaging the cryocooling processes of crystals has been demonstrated showing the progression of a cold wave through a crystal from the face closest to the origin of the coldstream ending at the point furthest away. During these studies large volume crystals were clearly distinguished from the loop holding them. Large volume crystals, used for neutron studies, were chosen deliberately to enhance the imaging. The different infrared transmission and reflectance properties of the crystal in comparison to the cryo-protectant are thought to be the parameter that produces the contrast making the crystal visible. As an application of the technology to locating crystals, more small crystals of lysozyme and a bFGF/dna complex were cryo-protected and imaged in large loops. The crystals were clearly distinguished from the vitrified solution. In the case of the bFGF/dna complex the illumination had to be carefully manipulated to enable the crystal to be seen in the visible spectrum. These preliminary results will be presented along with advantages and disadvantages of the technique and a discussion of how it might be applied.
Author
Cryogenic Cooling; Infrared Imagery; Deoxyribonucleic Acid; Crystals; Infrared Radiation

20030062119 NASA Marshall Space Flight Center, Huntsville, AL, USA
Pore Formation and Mobility Investigation (PFMI): Description and Initial Analysis of Experiments Conducted aboard the International Space Station
Grugel, R. N.; Anilkumar, A. V.; Lee, C. P.; [2002]; 1 pp.; In English; International Symposium on Physical Sciences in Space, 4-8 May 2003, Toronto, Canada; Copyright; Avail: Other Sources; Abstract Only

Flow visualization experiments during the controlled directional melt back and re-solidification of succinonitrile (SCN) and SCN-water mixtures were conducted using the Pore Formation and Mobility Investigation (PFMI) apparatus in the glovebox facility (GBX) aboard the International Space Station. The study samples were initially 'cast' on earth under 450 millibar of nitrogen into 1 cm ID glass sample tubes approximately 30 cm in length, containing 6 in situ thermocouples. During the Space experiments, the processing parameters and flow visualization settings are remotely monitored and manipulated from the ground Telescience Center (TSC). The ground solidified sample is first subjected to a unidirectional melt back, generally at 10 microns per second, with a constant temperature gradient ahead of the melting interface. Bubbles of different sizes are seen to initiate at the melt interface and, upon release from the melting solid, translate at different speeds in the temperature field ahead of them before coming to rest. Over a period of time these bubbles dissolve into the melt. The gas-laden liquid is then directionally solidified in a controlled manner, generally starting at a rate of 1 micron /sec. Observation and preliminary analysis of bubble formation and mobility in pure SCN samples during melt back and the subsequent structure resulting during gas generation upon re-solidification are presented and discussed.
Author
Flow Visualization; Mobility; Spaceborne Experiments; Melts (Crystal Growth); Solidification

20030062132 NASA Marshall Space Flight Center, Huntsville, AL, USA
CME Prediction from Magnetograms
Falconer, D. A.; Moore, R. L.; Gary, G. A.; [2003]; 1 pp.; In English; Solar, Heliospheric and Interplanetary Environment (SHINE), 6-11 Jul. 2003, Maui, HI, USA; No Copyright; Avail: CASI; A01, Hardcopy

We have found that active regions that are likely to be CME productive can be identified from measures of their nonpotentiality from magnetograms. We have developed four different measures from vector magnetograms and another that can be obtained from a line-of-sight magnetogram. We find that all five measures are strongly correlated with CME productivity to a similar degree. Hence, all five are roughly equally good predictors of active-region CME productivity. Since the measures all have similar predictive ability, the measures that are easiest to reliably measure are the best for operational forecasting of CMEs. The two best measures are the length of strong-shear main neutral line L(sub SS) (the length of the main neutral line with the magnetic shear angle greater than 45deg and observed transverse field greater than 150G) and the length of strong-gradient main neutral line L(sub G) (the length of the main neutral line with line-of-sight magnetic field greater than 50G/Mm and potential transverse field greater than 150G). As L(sub G) is measured from line-of-sight magnetograms it opens the larger data base of SOHO/MDI and Kitt Peak line-of-sight magnetograms for CME prediction study. This is especially important for evolutionary studies, with SOHO/MDI having no daylight, cloudy weather, or atmospheric seeing problems.
Author
Magnetic Signatures; Line Of Sight; Seeing (Astronomy); Magnetic Fields; Predictions

20030062176 NASA Marshall Space Flight Center, Huntsville, AL, USA
JSC Mars-1 Martian Soil Simulant: Melting Experiments and Electron Microprobe Studies
Carpenter, P.; Sebille, L.; Boles, W.; Chadwell, M.; Schwarz, L.; January 2003; 1 pp.; In English
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Other Sources; Abstract Only

JSC Mars-1 has been developed as a Martian regolith simulant, and is the <1 mm size fraction of a palagonitic tephra (a glassy volcanic ash altered at low temperatures) from Pu'u Nene cinder cone on the Island of Hawaii. The Mars-1 simulant forms the basis for numerous terrestrial studies which aim to evaluate the suitability of Martian soil for materials processing. Martian soil may be sintered to form building materials for construction, and also melted or reacted to extract metals for various uses, as well as oxygen for life support.
Author
Soils; Electron Probes; Sintering; Melting

20030062190 NASA Marshall Space Flight Center, Huntsville, AL, USA
Residual Gas in Closed Systems: Development of Gas in Silica Ampoules
Palosz, W.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The amounts and composition of residual gases formed in sealed silica glass ampoules were investigated. The effect of the silica brand, outgassing and annealing conditions, system geometry, and a presence of graphite were determined and discussed.
Author
Residual Gas; Silica Glass; Degassing; Gas Composition; Annealing

20030062249 NASA Langley Research Center, Hampton, VA, USA
Videogrammetry Using Projected Circular Targets: Proof-of-Concept Test
Black, Jonathan T.; Pappa, Richard S.; [2003]; 10 pp.; In English; 21st International Modal Analysis Conference, 3-6 Feb. 2003, Kissimmee, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

Videogrammetry is the science of calculating 3D object coordinates as a function of time from image sequences. It expands the method of photogrammetry to multiple time steps enabling the object to be characterized dynamically. Photogrammetry achieves the greatest accuracy with high contrast, solid-colored circular targets. The high contrast is most often effected using retro-reflective targets attached to the measurement article. Knowledge of the location of each target allows those points to be tracked in a sequence of images, thus yielding dynamic characterization of the overall object. For ultra-lightweight and inflatable gossamer structures (e.g. solar sails, inflatable antennae, sun shields, etc.) where it may be desirable to avoid physically attaching retro-targets, a high-density grid of projected circular targets - called dot projection - is a viable alternative. Over time the object changes shape or position independently of the dots. Dynamic behavior, such as deployment or vibration, can be characterized by tracking the overall 3D shape of the object instead of tracking specific object points. To develop this method, an oscillating rigid object was measured using both retro- reflective targets and dot projection. This paper details these tests, compares the results, and discusses the overall accuracy of dot projection videogrammetry.
Author
Photogrammetry; Dynamic Characteristics; Time Dependence; Inflatable Structures

20030062257 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lifetime Predictions of a Titanium Silicate Glass with Machined Flaws
Tucker, Dennis S.; Nettles, Alan T.; Cagle, Holly; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A dynamic fatigue study was performed on a Titanium Silicate glass to assess its susceptibility to delayed failure and to compare the results with those of a previous study. Fracture mechanics techniques were used to analyze the results for the purpose of making lifetime predictions. The material strength and lifetime was seen to increase due to the removal of residual stress through grinding and polishing. Influence on time-to-failure is addressed for the case with and without residual stress present. Titanium silicate glass otherwise known as ultra-low expansion (ULE)* glass is a candidate for use in applications requiring low thermal expansion characteristics such as telescope mirrors. The Hubble Space Telescope s primary mirror was manufactured from ULE glass. ULE contains 7.5\% titanium dioxide which in combination with silica results in a homogenous glass with a linear expansion coefficient near zero. delayed failure . This previous study was based on a 230/270 grit surface. The grinding and polishing process reduces the surface flaw size and subsurface damage, and relieves residual stress by removing the material with successively smaller grinding media. This results in an increase in strength of the optic during the grinding and polishing sequence. Thus, a second study was undertaken using samples with a surface finish typically achieved for mirror elements, to observe the effects of surface finishing on the time-to-failure predictions. An allowable stress can be calculated for this material based upon modulus of rupture data; however, this does not take into account the problem of delayed failure, most likely due to stress corrosion, which can significantly shorten lifetime. Fortunately, a theory based on

fracture mechanics has been developed enabling lifetime predictions to be made for brittle materials susceptible to delayed failure. Knowledge of the factors governing the rate of subcritical flaw growth in a given environment enables the development of relations between lifetime, applied stress and failure probability for the material under study. Dynamic fatigue is one method of obtaining the necessary information to develop these relationships. In this study, the dynamic fatigue method was used to construct a time-to-failure diagram for polished ULE glass.
Author
Silica Glass; Titanium Oxides; Fracture Mechanics; Prediction Analysis Techniques; Life (Durability); Residual Stress; Polishing

20030062851 NASA Langley Research Center, Hampton, VA, USA
NASA Vision
Prior, Edwin J.; National Educators' Workshop: Update 2002 - Standard Experiments in Engineering, Materials Science, and Technology; May 2003, pp. 289-313; In English; See also 20030062842; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The political, economic, and enivronmental conditions of the twenty-first century demand new goals for NASA. These goals include the imaging of habitable extrasolar planets, expanded commercialization of low earth orbit, clean and rapid air transportation, environment protection, and distance learning. The presentation recommends strategies for pursuing these goals, and summarizes activities at NASA Langley Research Center (LaRC).
Author
NASA Programs; Research Facilities; Extrasolar Planets; Planet Detection; Space Commercialization; Air Transportation; Environment Protection; Education

20030063147 NASA Ames Research Center, Moffett Field, CA, USA
A Draft Test Protocol for Detecting Possible Biohazards in Martian Samples Returned to Earth
Rummel, John D., Editor; Race, Margaret S.; DeVincenzi, Donald L.; Schad, P. Jackson; Stabekis, Pericles D.; Viso, Michel; Acevedo, Sara E.; October 31, 2002; 123 pp.; In English
Report No.(s): NASA/CP-2002-211842; A-0208825; NAS 1.55:211842; Copyright; Avail: CASI; A06, Hardcopy

This document presents the first complete draft of a protocol for detecting possible biohazards in Mars samples returned to Earth: it is the final product of the Mars Sample Handling Protocol Workshop Series. convened in 2000-2001 by NASA's Planetary Protection Officer. The goal of the five-workshop Series vas to develop a comprehensive protocol by which returned martian sample materials could be assessed k r the presence of any biological hazard(s) while safeguarding the purity of the samples from possible terrestrial contamination.
Author
Mars Surface Samples; Contamination; Hazards; Planetary Protection

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030062020 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chandra Observations of the Faintest Low-Mass X-ray Binaries
Wilson, Colleen A.; Patel, Sandeep K.; Kouveliotou, Chryssa; Jonker, Peter G.; vanderKlis, Michiel; Lewin, Walter H. G.; Belloni, Tomaso; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

There exists a group of persistently faint galactic X-ray sources that, based on their location in the galaxy, high L(sub X)/L(sub opt), association with X-ray bursts, and absence of low frequency X-ray pulsations, are thought to be low-mass X-ray binaries (LMXBs). We present results from Chandra observations for 8 of these systems: 4U 1708-408, 2S 1711-339, KS 1739-304, SLX 1735-269, GRS 1736-297, SLX 1746-331, 1E 1746.7-3224, and 4U 1812-12. Locations for all sources, excluding GRS 1736-297, SLX 1746-331, and KS 1739-304 (which were not detected) were improved to 0.6 sec error circles (90\% confidence). Our observations support earlier findings of transient behavior of GRS 1736-297, KS 1739-304, SLX 1746-331, and 2S 1711-339 (which we detect in one of two observations). Energy spectra for 4U 1708-408,2S 1711-339, SLX

1735-269, 1E 1746.7-3224, and 4U 1812-12 are hard, with power law indices typically 1.4-2.1, which are consistent with typical faint LMXB spectra.
Author
X Ray Binaries; X Ray Astronomy; Accretion Disks

20030062026 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Study of the X-ray Source Population in the Dwarf Galaxy NGC 6822
Tennant, Allyn F.; Swartz, Douglas A.; Ghosh, Kajal K.; Wu, Kinwah; [2003]; 1 pp.; In English; American Astronomical Society, 25-29 May 2003, Nashville, TN, USA; Copyright; Avail: Other Sources; Abstract Only

The dlrr galaxy NGC 6822 is a distant member of the Local Group. It is a site of recent star formation, rich in HII regions and OB associations, as well as containing an older globular cluster population. We present results of a deep Chandra observation of NGC 6822. The brightest source is extended and most likely a SNR. In addition to spectral analysis of the brightest sources, we extend the luminosity function down to the 10(sup)35 erg/s range.
Author
X Ray Astronomy; X Ray Sources; Dwarf Galaxies; Local Group (Astronomy); Star Formation

20030062029 NASA Marshall Space Flight Center, Huntsville, AL, USA
EXIST: The Next Large GRB Observatory
Fishman, Gerald J.; [2003]; 1 pp.; In English; EXIST Science Working Group Meeting, 23-26 Mar. 2003, Mt. Tremblant, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

Studies have begun on the EXIST (Energetic X-ray Imaging Survey Telescope) Mission as a Black Hole Survey 'Einstein Probe', a major element in the new NASA Beyond Einstein Program in the Office of Space Science. This program was approved by the US Congress, in February 2003 as part of the NASA FY2004 NASA budget. EXIST is planned as a very wide-field coded aperture telescope and a positional accuracy for GRBs better than one arc-minute. The baseline detectors are Cadmium-Zinc-Telluride (CZT), with a total sensitive area of approximately 8 m2. EXIST will use SWIFT as a pathfinder mission; the findings of SWIFT will refine the scientific objectives of EXIST and will help to determine many of its design parameters. EXIST will study early star and galaxy formation at high redshifts through observations of thousands of GRBs, their afterglows and host galaxies. It is intended that the international GRB community will play a large role in EXIST through direct participation as well as with complementary observational programs, both space-based and ground-based. Some preliminary design features and capabilities of the EXIST Mission will be presented.
Author
X Ray Telescopes; X Ray Astronomy; Gamma Ray Bursts; Astronomical Observatories

20030062112 NASA Marshall Space Flight Center, Huntsville, AL, USA
Determining the Cosmic Distance Scale from Interferometric Measurements of the Sunyaev-Zeldovich Effect
Reese, Erik D.; Carlstrom, John E.; Joy, Marshall; Mohr, Joseph; Grego, Laura; Holzapfel, William L.; The Astrophysical Journal; 2002; Volume 581, pp. 53-85; In English
Contract(s)/Grant(s): NAG5-7986; NGT5-50173; PF-1-2020; Copyright; Avail: Other Sources

We determine the distances to 18 galaxy clusters with redshifts ranging from z approximately 0.14 to 0.78 from a maximum likelihood joint analysis of 30 GHz interferometric Sunyaev-Zeldovich effect (SZE) and X-ray observations. We model the intracluster medium (ICM) using a spherical isothermal Beta model. We quantify the statistical and systematic uncertainties inherent to these direct distance measurements, and we determine constraints on the Hubble parameter for three different cosmologies. These distances imply a Hubble constant of 60(sup+4+13)(sub-4-18)km s(exp -1)Mpc(exp -1) for an omega(sub Mu)= 0.3,omega(sub Lambda)=0.7 cosmology, where the uncertainties correspond to statistical followed by systematic at 68\% confidence. With a sample of 18 clusters, systematic uncertainties clearly dominate. The systematics are observationally approachable and will be addressed in the coming years through the current generation of X-ray satellites (Chandra and XMM-Newton) and radio observatories (Owens Valley Radio Observatory, Berkeley-Illinois-Maryland Association, and Very Large Array). Analysis of high-redshift clusters detected in future SZE and X-ray surveys will allow a determination of the geometry of the universe from SZE-determined distances.
Author
Distance; Galactic Clusters; Red Shift; Cosmic Microwave Background Radiation; Sunyaev-Zeldovich Effect; Astronomical Models

20030062168 NASA Marshall Space Flight Center, Huntsville, AL, USA

A Very Energetic Supernova Associated with the Gamma Ray Burst of 29 March 2003

Hjorth, Jens; Sollerman, Jesper; Moller, Palle; Fynbo, Johan P. U.; Woosley, Stan E.; Kouvelioto, Chryssa; Tanvir, Nial R.; Greiner, Jochen; Andersen, Michael I.; Castro-Tirado, Alberto, et al.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Over the past five years evidence has mounted that long-duration (greater than 2s) gamma-ray bursts (GRBs), the most brilliant of all astronomical explosions, signal the collapse of massive stars in our Universe. This evidence, originally based on the probable association of one unusual GRB with a supernova, now includes the association of GRBs with regions of massive star-formation in distant galaxies, tantalizing evidence of supernova-like light-curve 'bumps' in the optical afterglows of several bursts, and lines of freshly synthesized elements in the spectra of a few X-ray afterglows. These observations support, but do not yet conclusively validate, models based upon the deaths of massive stars, presumably associated with core collapse. Here we report evidence for a very energetic supernova (a hypernova), temporally and spatially coincident with a GRB at redshift z=0.1685. The timing of the supernova indicates that it exploded within a few days of the GRB, strongly suggesting that core-collapse events can give rise to GRBs. Amongst the GRB central engine models proposed to-date, the properties of this supernova thus favour the collapsar model.

Author

Gamma Ray Bursts; Supernovae; Stellar Mass Ejection; Massive Stars; Astronomical Models

20030062177 NASA Marshall Space Flight Center, Huntsville, AL, USA

Chandra Phase-Resolved X-Ray Spectroscopy of the Crab Pulsar

Weisskopf, Martin C.; ODell, Stephen L.; Paerels, Frits; Elsner, Ronald F.; Becker, Werner E.; Tennant, Allyn F.; Swartz, Douglas A.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We present here the first phase-resolved study of the X-ray spectral properties of the Crab Pulsar that covers all pulse phases. The superb angular resolution of the Chandra X-ray Observatory enables distinguishing the pulsar from the surrounding nebulosity, even at pulse minimum. Analysis of the pulse-averaged spectrum measures interstellar photoelectric absorption and scattering by dust grains in the direction of the Crab Nebula. Analysis of the spectrum as a function of pulse phase measures the low-energy X-ray spectral index even at pulse minimum - albeit with large statistical uncertainty. The data are used to set a new upper limit to any thermal component.

Author

X Ray Spectroscopy; Crab Nebula; Spectroscopic Analysis; Electromagnetic Scattering; Cosmic Dust

20030062241 NASA Marshall Space Flight Center, Huntsville, AL, USA

How Sample Completeness Affects Gamma-Ray Burst Classification

Hakkila, Jon; Giblin, Timothy W.; Roiger, Richard J.; Haglin, David J.; Paciesas, William S.; Meegan, Charles A.; The Astrophysical Journal; January 1, 2003; Volume 582, pp. 320-329; In English

Contract(s)/Grant(s): NRA-98-OSS-03; NSF AST-00-98499; Copyright; Avail: Other Sources

Unsupervised pattern-recognition algorithms support the existence of three gamma-ray burst classes: class 1 (long, large-fluence bursts of intermediate spectral hardness), class 2 (short, small-fluence, hard bursts), and class 3 (soft bursts of intermediate durations and fluences). The algorithms surprisingly assign larger membership to class 3 than to either of the other two classes. A known systematic bias has been previously used to explain the existence of class 3 in terms of class 1 ; this bias allows the fluences and durations of some bursts to be underestimated, as recently shown by Hakkila et al. We show that this bias primarily affects only the longest bursts and cannot explain the bulk of the class 3 properties. We resolve the question of class 3's existence by demonstrating how samples obtained using standard trigger mechanisms fail to preserve the duration characteristics of small-peak flux bursts. Sample incompleteness is thus primarily responsible for the existence of class 3. In order to avoid this incompleteness, we show how a new, dual-timescale peak flux can be defined in terms of peak flux and fluence. The dual-timescale peak flux preserves the duration distribution of faint bursts and correlates better with spectral hardness (and presumably redshift) than either peak flux or fluence. The techniques presented here are generic and have applicability to the studies of other transient events. The results also indicate that pattern recognition algorithms are sensitive to sample completeness; this can influence the study of large astronomical databases, such as those found in a virtual observatory.

Author

Gamma Ray Bursts; Pattern Recognition; Algorithms; Classifications; Gamma Rays

20030063021 NASA Ames Research Center, Moffett Field, CA, USA

Callisto: A World in its Own Right

Moore, Jeffrey M.; Schenk, Paul M.; [2003]; 1 pp.; In English; Forum on Concepts and Approaches for Jupiter Icy Moons Orbiter, 12-14 Jun. 2003, Houston, TX, USA

Contract(s)/Grant(s): RTOP 344-30-21-03; No Copyright; Avail: CASI; A01, Hardcopy

Callisto, once unknown and then disregarded after Voyager, has emerged in the post-Galileo era worthy of the same intense scientific scrutiny that is lavished upon her sisters, playing an essential role in our understanding of the evolution of icy moons, and in a larger sense, the grand tapestry of solar system history. Along with the discovery of Callisto s con- ducting, probably fluid sub-surface layer, major Gulileo discoveries about Callisto include the complete absence of cryo-volcanic resurfacing, the relatively undifferentiated interior, and the presence of massive landform erosion from sublimation processes. Callisto s landscape at decameter scales is unique among the Galilean satellites, and might be most akin to that of cometary nuclei. The process of sublimation degradation, previously underappreciated, is now recognized as a major surface modification process on Callisto. Its role in mass wasting and landslide initiation was elemental in creating the bizarre and astonishing scenery imaged by Galileo.

Author

Callisto; Landforms; Volcanoes; Topography; Degradation; Comet Nuclei

20030063030 California Univ., Los Angeles, CA, USA

The Meteoritic Component in Impact Deposits

Kyte, Frank T.; [2002]; 3 pp.; In English; 10th Rubey Coloquium, 9-10 Feb. 2002, Los Angeles, CA, USA

Contract(s)/Grant(s): NAG5-9441; No Copyright; Avail: CASI; A01, Hardcopy

An important part of the history of impacts on Earth, and their influence on the terrestrial environment and biotic evolution, is the provenance of the impacting bolides. This will reflect the history of the large-body object flux in the inner solar system. The physical and chemical properties of projectiles, as well as their orbital evolution, has influenced the dynamics and the relative timing of impact events. Possible impact scenarios include random impacts by individual asteroids or comets, or clusters of impacts due to major collisions in the asteroid or Kuiper belts, or large perturbations of the Oort cloud of comets. Over the last several years, a combination of trace element, isotopic, and petrologic data have yielded significant insights into this impact history. The trace element chemistry of sediments, in particular the concentration of siderophiles (e.g., Ir), is a useful tool to detect impacts and provides supporting evidence for suspected impact deposits. However, siderophiles are not especially useful in distinguishing between types of projectiles. Interelement abundances of PGEs can distinguish a chondritic signature, but since most asteroids, and probably all comets are chondritic, these data do little to distinguish between chondritic source materials. Perhaps the most significant chemical argument used to constrain provenance, is that the total amount of Ir in the global Cretaceous-Tertiary (KT) boundary ejecta layer is considerably less than that expected by a low-velocity, 10 km asteroid impact and is most consistent with the impact of a high-velocity, low-Ir comet. Alternatively, much of the Ir may have been buried in the Chicxulub crater and/or ejected to escape velocity.

Derived from text

Bolides; Chemical Properties; Comets; Craters; Meteorite Collisions; Hypervelocity Impact

20030063132 Michigan Univ., Ann Arbor, MI, USA

MGS Radio Science Electron Density Profiles: Interannual Variability and Implications for the Martian Neutral Atmosphere

Bougher, Stephen W.; Engel, S.; Hinson, D. P.; Murphy, J. R.; January 2003; 51 pp.; In English

Contract(s)/Grant(s): NAG5-12442; Copyright; Avail: Other Sources

Martian electron density profiles provided by the Mars Global Surveyor (MGS) Radio Science (RS) experiment over the 95-200 km altitude range indicate that the height of the electron peak and the longitudinal structure of the peak height are sensitive indicators of the physical state of the Mars lower atmosphere. The present analysis is carried out on five sets of occultation profiles, all at high solar zenith angles (SZA). Variations spanning 2-Martian years are investigated near aphelion conditions at high Northern latitudes (64.7-77.6N). A mean ionospheric peak height of 133.5-135 km was obtained for all aphelion profiles near SZA = 78-82; a corresponding mean peak density of 7.3-8.5 x 10(exp 4)/cu cm was also measured, reflecting solar moderate conditions. Strong wave 2-3 oscillations in peak heights were observed as a function of longitude over both Martian seasons. The Mars Thermospheric General Circulation Model (MTGCM) is exercised for Mars aphelion conditions. The measured interannual variations in the mean and longitude structure of the peak heights are small (consistent with MTGCM simulations), signifying the repeatability of the Mars atmosphere during aphelion conditions. A non-migrating (semi-diurnal period, wave#l eastward propagating) tidal mode is likely responsible for the wave#3 longitude features

identified. The height of this photochemically driven peak can be observed to provide an ongoing monitor of the changing state of the Mars lower atmosphere. The magnitudes of these same peaks may reflect more than changing solar EUV fluxes when they are located in the vicinity of Mars crustal magnetic field centers.
Author
Electron Density Profiles; Mars Global Surveyor; Mars Atmosphere; Occultation; Atmospheric General Circulation Models; Electron Density (Concentration)

20030063152 Texas Univ., Austin, TX, USA
Analysis of ISO Data
Lambert, David L.; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-3348; No Copyright; Avail: CASI; A01, Hardcopy

A block grant supported several astronomers who executed observing programs using the Infrared Space Observatory (ISO). The ISO project in which Harriet Dinerstein participated was a study of sulfur and neon abundances in extragalactic H II regions using the ISO Short Wavelength Spectrometer (SWS). Evans and Jaffe, along with collaborators Ewine van Dishoeck and Wing-Fai Thi, and then graduate student Wenbin Li, carried out an in-depth study of the peripheral region of the molecular cloud L1204/S140, where the far ultraviolet radiation and the density are relatively low. Their observations test theories of photon-dominated regions (PDRs) in a regime that has been little explored. One ISO program was involved with PHT-32 observations of about a dozen young stars to search for extended emission that could be modeled with our dust-modeling-code at UT. The document reports on preliminary analysis of PHT 32 scanning of 10 pre-main-sequence stars at 50 and 100 microns. A small sample of R Coronae Borealis stars was observed with the SWS.
Derived from text
Infrared Space Observatory (Iso); Infrared Astronomy; Abundance; Sulfur; Neon; H Ii Regions; Molecular Clouds; Pre-Main Sequence Stars; A Stars

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030062059 NASA Marshall Space Flight Center, Huntsville, AL, USA
When Earth Songs Filled the Void of Space
Gallagher, Dennis L.; [2003]; 1 pp.; In English; Tennessee Association of American Physics Teachers, 28 Mar. 2003, Clarksville, TN, USA; No Copyright; Avail: Other Sources; Abstract Only

Before the late 50's we had the planets, our Sun, the stars, galaxies, spectacular clouds of dust and very little else in our universe. There was evidence for a highly tenuous 'sea' of dust in interstellar space, but little else. Space was empty above the ionized gases of our upper atmosphere, a little like there was no color in the world before the 40's. The clues were there to think otherwise, however, and in the late 50's and early 60's a few researchers dared to challenge the conventional ideas about space. It was a time of discovery and, with our new ability to fly in space, a time that launched a new science. Today that science makes it possible to literally see some of the plasmas that populate near-Earth space, which are now known to exist everywhere.
Author
Dust; Interstellar Space; Plasmas (Physics)

20030062077 NASA Marshall Space Flight Center, Huntsville, AL, USA
Measurement of Characteristics of Micron Size Individual Dust Particles of Astrophysical Interest
Craven, P. D.; Abbas, M. M.; Tankosic, D.; Spann, J. F.; [2003]; 1 pp.; In English; 10th Workshop on the Physics of Dusty Plasmas, 18-21 Jun. 2003, Saint Thomas, Virgin Islands (U.S.); Copyright; Avail: Other Sources; Abstract Only

A laboratory facility for levitating single isolated dust particles in an electrodynamic balance has been developed at NASA's Marshall Space Flight Center for conducting studies of the physical and optical properties of the analogs of interstellar and interplanetary dust grains of 0.2-20 micron size under controlled pressures/temperatures simulating astrophysical environments. We plan three classes of experiments using this facility: (1) Charge characteristics of micron size single dust grains: The photoelectric efficiencies, yields, and equilibrium potentials when exposed to UV radiation found from these measurements will provide much-needed photoelectric emission data for individual dust particles; (2) Infrared optical properties of dust particles: Specifically, we will determines the complex refractive indices, the extinction coefficients, the

scattering phase functions, and the polarization properties of single dust grains of interest in interstellar environments, in the 1- 25 micron spectral region; (3) Condensation experiments to investigate the deposition of volatile gases on colder nucleated particles in dense interstellar clouds and lower planetary atmospheres: The measured data will permit determination of the sticking efficiencies of volatile gases of astrophysical interest. Brief descriptions of the experimental setup for the last two classes of experiments will be given. We will present results of measurements of photoelectric emission using 0.2-6.6 micron size silica particles exposed to UV radiation at 120-200 nm and also results of radiation pressure measurements using the same size silica particles and laser light at 5320 Angstrom.
Author
Interplanetary Dust; Optical Properties; Electromagnetic Properties; Research Facilities

20030062079 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chandra Observations of M28
Weisskopf, Martin; Becker, Werner; Swartz, Douglas A.; Pavlov, George G.; Elsner, Ronald F.; Grindlay, Jonathan; Mignani, Roberto; Tennant, Allyn F.; Backer, Don; Pulone, Luigi, et al.; [2003]; 1 pp.; In English; Restless High-Energy Universe, 5-8 May 2003, Amsterdam, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

We report the results of the first Chandra X-Ray Observatory observations of the globular cluster M28 (NGC 6626). We detect 46 X-ray sources of which 12 lie within one core radius of the center. We show that the apparently extended X-ray core emission seen with the ROSAT HRI is due to the superposition of multiple discrete sources for which we determine the X-ray luminosity function down to a limit of about $6\times 10(exp 30)$ erg/s$. We measure for the first time the unconfused phase-averaged X-ray spectrum of the 3.05-ms pulsar B 1821-24. We also present spectral analyses of the 5 brightest unidentified sources.
Author
Globular Clusters; X Ray Sources; Luminosity; Spectrum Analysis

20030062106 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chandra X-Ray Observations of the Spiral Galaxy M81
Swartz, Douglas A.; Ghosh, Kajal K.; McCollough, Michael L.; Pannuti, Thomas G.; Tennant, Allyn F.; Wu, Kinwah; The Astrophysical Journal Supplement Series; February 2003; Volume 144, pp. 213-242; In English
Contract(s)/Grant(s): GO0-1058X; AR2-3008X; Copyright; Avail: Other Sources

A Chandra X-Ray Observatory ACIS-S imaging observation is used to study the population of X-ray sources in the nearby Sab galaxy M81 (NGC 3031). A total of 177 sources are detected with 124 located within the D(sub 25) isophote to a limiting X-ray luminosity of approx. 3 x 10(exp 36) ergs/s. Source positions, count rates, luminosities in the 0.3-8.0 keV band, limiting optical magnitudes, and potential counterpart identifications are tabulated. Spectral and timing analysis of the 36 brightest sources are reported including the low luminosity active galactic nucleus, SN 1993J, and the Einstein-discovered ultraluminous X-ray source X6. The nucleus accounts for approx. 86\%, or 5 x 10(exp 40) ergs/s, of the total X-ray emission from M81. Its spectrum is well fitted by an absorbed power law with photon index 1.98 +/- 0.08, consistent with previous observations (average index 1.9). SN 1993J has softened and faded since its discovery. At an age of 2594 days, SN 1993J displayed a complex thermal spectrum from a reverse shock rich in Fe L and highly ionized Mg, Si, and S but lacking O. A hard X-ray component, emitted by a forward shock, is also present. X6 is spatially coincident with a stellar object with optical brightness and colors consistent with an O9-B1 main-sequence star. It is also coincident with a weak radio source with a flux density of approx. 95 microJy at lambda = 3.6 cm. The continuum-dominated X-ray spectrum of X6 is most closely reproduced by a blackbody disk model suggesting the X-ray source is an approx. 18 solar mass object accreting at nearly its Eddington limit.
Author
Spiral Galaxies; X Ray Astronomy; X Ray Sources; X Ray Spectra

20030062185 NASA Marshall Space Flight Center, Huntsville, AL, USA
On the Nature of the Eclipsing Bright X-ray Source in the Circinus Galaxy Field
Weisskopf, M. C.; Wu, K.; Tennant, A. F.; Swartz, D. A.; [2003]; 1 pp.; In English; HEAD 2003: Seventh Meeting of the AAS High Energy Astrophysics Division, 23-26 Mar. 2003, Mt. Tremblant, Quebec, Canada; Copyright; Avail: Other Sources; Abstract Only

The X-ray spectrum and light curve of the bright source CG X-1 in the field of the Circinus galaxy are re-examined. Previous analyses have concluded that the source is an accreting black hole of about 50 solar masses although it was noted

that the light curve resembles that of an AM Her-type system. Here we show that the light curve and orbital dynamics constrain the mass of the compact object to less than 30 solar masses and the mass of the companion to less than 1 solar mass. Combining the mass constraints with the observed X-ray flux, we show that an accreting object must either radiate anisotropically or strongly violate the Eddington limit. If the emission is beamed, then the companion star, which intercepts this flux during eclipse, will be driven out of thermal equilibrium and evaporate within approx. 103 yr. We find, therefore, that the observations are most consistent with the interpretation of CG X-1 as a bright, long-period, AM Her system in the Milky Way.
Author
X Ray Astronomy; X Ray Sources; Eclipsing Binary Stars; X Ray Spectra; Light Curve

20030062240 NASA Marshall Space Flight Center, Huntsville, AL, USA
Finite Element Method for Capturing Ultra-relativistic Shocks
Richardson, G. A.; Chung, T. J.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

While finite element methods are used extensively by researchers solving computational fluid dynamics in fields other than astrophysics, their use in astrophysical fluid simulations has been predominantly overlooked. Current simulations using other methods such as finite difference and finite volume (based on finite difference) have shown remarkable results, but these methods are limited by their fundamental properties in aspects that are important for simulations with complex geometries and widely varying spatial and temporal scale differences. We have explored the use of finite element methods for astrophysical fluids in order to establish the validity of using such methods in astrophysical environments. We present our numerical technique applied to solving ultra-relativistic (Lorentz Factor Gamma >> 1) shocks which are prevalent in astrophysical studies including relativistic jets and gamma-ray burst studies. We show our finite element formulation applied to simulations where the Lorentz factor ranges up to 2236 and demonstrate its stability in solving ultra-relativistic flows. Our numerical method is based on the Flowfield Dependent Variation (FDV) Method, unique in that numerical diffusion is derived from physical parameters rather than traditional artificial viscosity methods. Numerical instabilities account for most of the difficulties when capturing shocks in this regime. Our method results in stable solutions and accurate results as compared with other methods.
Author
Finite Element Method; Computational Fluid Dynamics; Flow Distribution; Finite Volume Method; Astrophysics

20030062961 NASA Ames Research Center, Moffett Field, CA, USA
Blowing in the Wind: II. Creation and Redistribution of Refractory Inclusions in a Turbulent Protoplanetary Nebula
Cuzzi, Jeffrey N.; Davis, Sanford S.; Dobrovolskis, Anthony R.; [2003]; 35 pp.; In English
Contract(s)/Grant(s): RTOP 344-37-22-03; No Copyright; Avail: CASI; A03, Hardcopy

Ca-A1 rich refractory mineral inclusions (CAIs) found at 1-6\% mass fraction in primitive chondrites appear to be 1-3 million years older than the dominant (chondrule) components which were accreted into the same parent bodies. A prevalent concern is that it is difficult to retain CAIs for this long against gas-drag-induced radial drift into the sun. We reassess the situation in terms of a hot inner (turbulent) nebula context for CAI formation, using analytical models of nebula evolution and particle diffusion. We show that outward radial diffusion in a weakly turbulent nebula can overwhelm inward drift, and prevent significant numbers of CAI-size particles from being lost into the sun for times on the order of 10(exp 6) years. CAIs can form early, when the inner nebula was hot, and persist in sufficient abundance to be incorporated into primitive planetesimals at a much later time. Small (less than or approximately 0.1 mm diameter) CAIs persist for longer times than large (greater than or approximately 5mm diameter ones. To obtain a quantitative match to the observed volume fractions of CAIs in chondrites, another process must be allowed for: a substantial enhancement of the inner hot nebula in silicate-forming material, which we suggest was caused by rapid inward drift of meter-sized objects. This early in nebula history, the drifting rubble would have a carbon content probably an order of magnitude larger than even the most primitive (CI) carbonaceous chondrites. Abundant carbon in the evaporating material would help keep the nebula oxygen fugacity low, plausibly solar; as inferred for the formation environment of CAIs. The associated production of a larger than canonical amount of CO2 might also play a role in mass-independent fractionation of oxygen isotopes, leaving the gas rich in O-16 as inferred from CAIs and other high temperature condensates.
Author
Astronomical Models; Chondrites; Mathematical Models; Particle Diffusion; Solar Nebula; Meteoritic Composition; Chemical Composition; Minerals

20030063061 Institut Rudjer Boskovic, Zagreb, Croatia
Space, Time and Life
Bosanac, S. D.; Dec. 16, 2002; 65 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F61775-01-WF037
Report No.(s): AD-A411632; CSP-01-5037; No Copyright; Avail: CASI; A04, Hardcopy

The Book of Abstracts for papers presented: Space, time and Life, 26 August 2002 - 30 August 2002. Some topics include Structure and evolution of the universe, life and entropy, and nano-scale phenomena.
DTIC
Large-Scale Structure Of The Universe; Time; Life Sciences; Entropy; Nanostructure (Characteristics)

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20030062099 NASA Marshall Space Flight Center, Huntsville, AL, USA
Transformational Concepts and Technologies For the Exploration and Development of Space
Howell, Joe T.; Mankins, John C.; [2003]; 1 pp.; In English; 54th International Astronautical Congress, 29 Sep. - 3 Oct. 2003, Bremen, Germany; Copyright; Avail: Other Sources; Abstract Only

The performance and cost of available systems and technologies limit the programmatic prospects for the U.S. and the international community to achieve ambitious goals and objectives in future human and robotic exploration and development of space. Innovative applications of emerging technologies and new systems concepts are vital to enabling future space systems and architectures. This paper will discuss new technologies and their application to transformational systems concepts in space utilities and power, space infrastructure, transportation and exploration.
Author
Aerospace Systems; Space Exploration; Space Transportation

20030062261 Computer Sciences Corp., Huntsville, AL, USA
Mars Global Reference Atmospheric Model (Mars-GRAM) and Database for Mission Design
Justus, C. G.; Duvall, Aleta; Johnson, D. L.; January 13, 2003; 2 pp.; In English; Mars Atmosphere Modeling and Observations, 13-15 Jan. 2003, Granada, Spain
Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: Other Sources; Abstract Only

Mars Global Reference Atmospheric Model (Mars-GRAM 2001) is an engineering-level Mars atmosphere model widely used for many Mars mission applications. From 0-80 km, it is based on NASA Ames Mars General Circulation Model, while above 80 km it is based on Mars Thermospheric General Circulation Model. Mars-GRAM 2001 and MGCM use surface topography from Mars Global Surveyor Mars Orbiting Laser Altimeter. Validation studies are described comparing Mars-GRAM with Mars Global Surveyor Radio Science and Thermal Emission Spectrometer data. RS data from 2480 profiles were used, covering latitudes 75 deg S to 72 deg N, surface to approximately 40 km, for seasons ranging from areocentric longitude of Sun (Ls) = 70-160 deg and 265-310 deg. RS data spanned a range of local times, mostly 0-9 hours and 18-24 hours. For interests in aerocapture and precision landing, comparisons concentrated on atmospheric density. At a fixed height of 20 km, RS density varied by about a factor of 2.5 over ranges of latitudes and Ls values observed. Evaluated at matching positions and times, these figures show average RSMars-GRAM density ratios were generally 1+/-)0.05, except at heights above approximately 25 km and latitudes above approximately 50 deg N. Average standard deviation of RSMars-GRAM density ratio was 6\%. TES data were used covering surface to approximately 40 km, over more than a full Mars year (February, 1999 - June, 2001, just before start of a Mars global dust storm). Depending on season, TES data covered latitudes 85 deg S to 85 deg N. Most TES data were concentrated near local times 2 hours and 14 hours. Observed average TES/Mars-GRAM density ratios were generally 1+/-0.05, except at high altitudes (15-30 km, depending on season) and high latitudes (greater than 45 deg N), or at most altitudes in the southern hemisphere at Ls approximately 90 and 180 deg. Compared to TES averages for a given latitude and season, TES data had average density standard deviation about the mean of approximately 2.5\% for all data, or approximately 1-4\%, depending on time of day and dust optical depth. Average standard deviation of TES/Mars-GRAM density ratio was 8.9\% for local time 2 hours and 7.1\% for local time 14 hours. Thus standard deviation of observed TES/Mars-GRAM density ratio, evaluated at matching positions and times, is about three times

the standard deviation of TES data about the TES mean value at a given position and season.
Author
Reference Atmospheres; Mars (Planet); Proving; Mars Atmosphere

20030062758 Smithsonian Institution, Cambridge, MA, USA
Millimeter and Submillimeter Spectroscopy of Titan
Gurwell, Mark A.; July 2003; 17 pp.; In English
Contract(s)/Grant(s): NAG5-7946; No Copyright; Avail: CASI; A03, Hardcopy

Our major goals for the first year of this program were to develop a general improved radiative transfer model of the atmosphere of Titan, and to accurately determine the global abundance of CO from observations obtained using the Owens Valley Radio Observatory Millimeter Array. Other goals were to reanalyze older data sets using the improved radiative transfer model and to observe other molecular species as time permitted. Our program was granted two Titan transits to measure the CO(2-1) rotational transition at low spatial resolution, and one transit to measure nitriles and organics in the 236-239 GHz spectral range. In year two, our program was granted two Titan transits to measure the CO(2-1) rotational transition at low spatial resolution, and one transit to measure nitriles and organics in the 236-239 GHz spectral range. The CO(2-1) observations were previously reported in a published paper
Derived from text
Titan; Satellite Atmospheres; Radiative Transfer; Atmospheric Models; Carbon; Millimeter Waves; Submillimeter Waves

20030063116 California Univ., Los Angeles, CA, USA
Data Report: A Search for Deposits of the Late Pliocene Impact of the Eltanin Asteroid in Rise Sediments from the Antarctic Peninsula, Site 1096
Kyte, Frank T.; [2003]; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9441; JOI-G3397; No Copyright; Avail: CASI; A02, Hardcopy

Concentrations of Ir have been measured in 87 sediment samples from Ocean Drilling Program Site 1096 in search of evidence of fallout from the impact of the Eltanin asteroid, which occurred at 2.15 Ma, approx. 1300 km northwest of the site. An additional six samples were measured from a unique sand layer and adjacent sediments that are dated at approx. 1.6 Ma. These 93 sediment samples are all silts and muds that were deposited on a continental rise drift of the Antarctic Peninsula. No evidence of the Eltanin impact deposit was found in this study.
Author
Deposits; Asteroids; Sediments; Iridium

20030063128 NASA Langley Research Center, Hampton, VA, USA
Revolutionary Concepts for Human Outer Planet Exploration (HOPE)
Troutman, Patrick A.; Bethke, Kristen; Stillwagen, Fred; Caldwell, Darrell L., Jr.; Manvi, Ram; Strickland, Chris; Krizan, Shawn A.; [2003]; 9 pp.; In English; Space Technology and Applications International Forum, 2-6 Feb. 2003, Albuquerque, NM, USA; Copyright; Avail: CASI; A02, Hardcopy

This paper summarizes the content of a NASA-led study performed to identify revolutionary concepts and supporting technologies for Human Outer Planet Exploration (HOPE). Callisto, the fourth of Jupiter's Galilean moons, was chosen as the destination for the HOPE study. Assumptions for the Callisto mission include a launch year of 2045 or later, a spacecraft capable of transporting humans to and from Callisto in less than five years, and a requirement to support three humans on the surface for a minimum of 30 days. Analyses performed in support of HOPE include identification of precursor science and technology demonstration missions and development of vehicle concepts for transporting crew and supplies. A complete surface architecture was developed to provide the human crew with a power system, a propellant production plant, a surface habitat, and supporting robotic systems. An operational concept was defined that provides a surface layout for these architecture components, a list of surface tasks, a 30-day timeline, a daily schedule, and a plan for communication from the surface.
Author
Habitats; Technologies; Robotics; Schedules

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030062034 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Coronal Heating and the Magnetic Flux Content of the Network
Moore, R. L.; Falconer, D. A.; Porter, J. G.; Hathaway, D. H.; [2003]; 1 pp.; In English; 34th Meeting of the Solar Physics Division of the American Astronomical Society, 16-20 Jun. 2003, Laurel, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

We investigate the heating of the quiet corona by measuring the increase of coronal luminosity with the amount of magnetic flux in the underlying network at solar minimum when there were no active regions on the face of the Sun. The coronal luminosity is measured from Fe IX/X-Fe XII pairs of coronal images from SOHO/EIT. The network magnetic flux content is measured from SOHO/MDI magnetograms. We find that the luminosity of the corona in our quiet regions increases roughly in proportion to the square root of the magnetic flux content of the network and roughly in proportion to the length of the perimeter of the network magnetic flux clumps. From (1) this result, (2) other observations of many fine-scale explosive events at the edges of network flux clumps, and (3) a demonstration that it is energetically feasible for the heating of the corona in quiet regions to be driven by explosions of granule-sized sheared-core magnetic bipoles embedded in the edges of network flux clumps, we infer that in quiet regions that are not influenced by active regions the corona is mainly heated by such magnetic activity in the edges of the network flux clumps. Our observational results together with our feasibility analysis allow us to predict that (1) at the edges of the network flux clumps there are many transient sheared-core bipoles of the size and lifetime of granules and having transverse field strengths greater than approximately - 100 G, (2) approximately 30 of these bipoles are present per supergranule, and (3) most spicules are produced by explosions of these bipoles.
Author
Solar Corona; Stellar Luminosity; Magnetic Flux; Plasma Heating; Solar Physics

20030062084 NASA Marshall Space Flight Center, Huntsville, AL, USA
SUMI - The Solar Ultraviolet Magnetograph Investigation
Porter, J. G.; West, E. A.; Davis, J. M.; Gary, G. A.; Noble, M. W.; Thomas, R. J.; Rabin, D. M.; Uitenbroek, H.; [2003]; 1 pp.; In English; 34th Meeting of the Solar Physics Division of the American Astronomical Society, 16-20 Jun. 2003, Laurel, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

Solar physics has been successful in characterizing the full vector magnetic field in the photosphere, where the ratio of gas pressure to magnetic pressure (Beta) is >1. However, at higher levels in the atmosphere, where Beta <<1 and flares and CMEs are believed to be triggered, observations are difficult, severely limiting the understanding of these processes. In response to this situation, we are developing SUMI (the Solar Ultraviolet Magnetograph Investigation) a unique instrument designed to measure the circular and linear polarization of upper chromospheric Mg II lines (280 nm) and circular polarization of transition region C IV lines (155 nm). To date the telescope mirrors have been built, tested and coated with dielectric stacks designed to reflect only the wavelengths of interest. We have also developed a unique UV polarimeter and completed the design of a high-resolution spectrograph that uses dual toroidal varied- line-space (TVLS) gratings. Incorporating measurements of those components developed so far, the revised estimate of the system throughput exceeds our original estimate by more than an order of magnitude. A sounding rocket flight is anticipated in 2006. Our objectives and progress are detailed in this presentation.
Author
Solar Physics; Magnetic Fields; Photosphere; Gas Pressure; Circular Polarization; Linear Polarization; Magnetometers

20030062133 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Coronal Heating and the Magnetic Flux Content of the Network
Falconer, D. A.; Moore, R. L.; Porter, J. G.; Hathaway, D. H.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We investigate the heating of the quiet corona by measuring the increase of coronal luminosity with the amount of magnetic flux in the underlying network at solar minimum when there were no active regions on the face of the Sun. The coronal luminosity is measured from Fe IX/X-Fe XII pairs of coronal images from SOHO/EIT. The network magnetic flux content is measured from SOHO/MDI magnetograms. We find that the luminosity of the corona in our quiet regions increases roughly in proportion to the square root of the magnetic flux content of the network and roughly in proportion to the length

of the perimeter of the network magnetic flux clumps. From (1) this result, (2) other observations of many fine-scale explosive events at the edges of network flux clumps, and (3) a demonstration that it is energetically feasible for the heating of the corona in quiet regions to be driven by explosions of granule-sized sheared-core magnetic bipoles embedded in the edges of network flux clumps, we infer that in quiet regions that are not influenced by active regions the corona is mainly heated by such magnetic activity in the edges of the network flux clumps. Our observational results together with our feasibility analysis allow us to predict that (1) at the edges of the network flux clumps there are many transient sheared-core bipoles of the size and lifetime of granules and having transverse field strengths > approx. 100 G, (2) approx. 30 of these bipoles are present per supergranule, and (3) most spicules are produced by explosions of these bipoles.
Author
Solar Corona; Solar Heating; Magnetic Flux; Luminosity; Solar Activity Effects

20030063080 NASA Marshall Space Flight Center, Huntsville, AL, USA
Observed Helicity of Active Regions in Solar Cycle 21
Hagyard, M. J.; Pevtsov, A. A.; Blehm, Z.; Smith, J. E.; Six, Frank, Technical Monitor; [2003]; 1 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

We report the results of a study of helicity in solar active regions during the peak of activity in solar cycle 21 from observations with the Marshall Space Flight Center's solar vector magnetograph. Using the force-free parameter alpha as the proxy for helicity, we calculated an average value of alpha for each of 60 active regions from a total of 449 vector magnetograms that were obtained during the period 1980 March to November. The signs of these average values of alpha were correlated with the latitude of the active regions to test the hemispheric rule of helicity that has been proposed for solar magnetic fields: negative helicity predominant in northern latitudes, positive in the southern ones. We have found that of the 60 regions that were observed, 30 obey the hemispheric rule and 30 do not.
Author
Solar Cycles; Solar Activity; Magnetic Storms; Solar Magnetic Field; Magnetic Signatures

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20030062061 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Chandra X-Ray Observatory Radiation Environment Model
Blackwell, W. C.; Minow, Joseph I.; Smith, Shawn; Swift, Wesley R.; ODell, Stephen L.; Cameron, Robert A.; [2003]; 1 pp.; In English; 41st American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Copyright; Avail: Other Sources; Abstract Only

CRMFLX (Chandra Radiation Model of ion FluX) is an environmental risk mitigation tool for use as a decision aid in planning the operations times for Chandra's Advanced CCD Imaging Spectrometer (ACIS) detector. The accurate prediction of the proton flux environment with energies of 100 - 200 keV is needed in order to protect the ACIS detector against proton degradation. Unfortunately, protons of this energy are abundant in the region of space Chandra must operate, and the on-board Electron, Proton, and Helium Instrument (EPHIN) does not measure proton flux levels of the required energy range. In addition to the concerns arising from the radiation belts, substorm injections of plasma from the magnetotail may increase the protons flux by orders of magnitude in this energy range. The Earth's magnetosphere is a dynamic entity, with the size and location of the magnetopause driven by the highly variable solar wind parameters (number density, velocity, and magnetic field components). Operational times for the telescope must be made weeks in advance, decisions which are complicated by the variability of the environment. CRMFLX is an engineering model developed to address these problems and provides proton flux and fluence statistics for the terrestrial outer magnetosphere, magnetosheath, and solar wind for use in scheduling ACIS operations. CRMFLX implements a number of standard models to predict the bow shock, magnetopause, and plasma sheet boundaries based on the sampling of historical solar wind data sets. Measurements from the GEOTAIL and POLAR spacecraft are used to create the proton flux database. This paper describes the recently released CRMFLX v2 implementation that includes an algorithm that propagates flux from an observation location to other regions of the magnetosphere based on convective ExB and VB-curvature particle drift motions in electric and magnetic fields. This technique has the advantage of

more completely filling out the database and makes maximum use of limited data obtained during high Kp periods or in areas of the magnetosphere with poor satellite coverage.
Author
Environment Models; Radiation Effects; Decision Support Systems; Solar Flux; Proton Flux Density; Solar Wind; Spaceborne Telescopes

20030062989 NASA Langley Research Center, Hampton, VA, USA
Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign
Wilson, J. W., Editor; Jones, I. W., Editor; Maiden, D. L., Editor; Goldhagen, P., Editor; February 2003; 424 pp.; In English; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign, 30-31 Mar. 1998, Hampton, VA, USA; See also 20030062990 - 20030063010; Original contains color illustrations
Contract(s)/Grant(s): RTOP 784-50-00-01
Report No.(s): NASA/CP-2003-212155; L-18242; NAS 1.55:212155; No Copyright; Avail: CASI; A18, Hardcopy

The USA initiated a program to assess the technology required for an environmentally safe and operationally efficient High Speed Civil Transport (HSCT) for entrance on the world market after the turn of the century. Due to the changing regulations on radiation exposures and the growing concerns over uncertainty in our knowledge of atmospheric radiations, the NASA High Speed Research Project Office (HSRPO) commissioned a review of 'Radiation Exposure and High-Altitude Flight' by the National Council on Radiation Protection and Measurements (NCRP). On the basis of the NCRP recommendations, the HSRPO funded a flight experiment to resolve the environmental uncertainty in the atmospheric ionizing radiation levels as a step in developing an approach to minimize the radiation impact on HSCT operations. To minimize costs in this project, an international investigator approach was taken to assure coverage with instrument sensitivity across the range of particle types and energies to allow unique characterization of the diverse radiation components. The present workshop is a result of the flight measurements made at the maximum intensity of the solar cycle modulated background radiation levels during the month of June 1997.
Author
Atmospheric Radiation; U-2 Aircraft; Ionizing Radiation; Supersonic Transports; High Speed; Extraterrestrial Radiation

20030062992 Boeing Co., Seattle, WA, USA
TEPC Measurements of High Altitude Radiation
Chee, Alexander; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 261-272; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Tissue Equivalent Proportional Counter (TEPC) that was flown by the Boeing Company was built by Battelle Pacific Northwest Laboratories and incorporates a special 5 inch detector built by Far West Technology, Inc. The overall construction of the TEPC is similar to those originally designed by P.W. Benjamin and associates (Benjamin et al. 1998). The detector was filled with a mixture of gases and pressurized to simulate a cavity of about two microns. The specifications of the TEPC are given.
Author
Proportional Counters; High Altitude; Radiation Measurement; Radiation Detectors; Tissues (Biology)

20030062993 NASA Langley Research Center, Hampton, VA, USA
Radiation-Related Risk Analysis for Atmospheric Flight Civil Aviation Flight Personnel
DeAngelis, G.; Wilson, J. W.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 351-367; In English; See also 20030062989; No Copyright; Avail: CASI; A03, Hardcopy

Human data on low dose rate radiation exposure and consequent effects are not readily available, and this fact generates groundtruth concerns for all risk assessment techniques for possible health effects induced by the space radiation environment, especially for long term missions like those foreseen now and in the near future. A large amount of such data may be obtained through civil aviation flight personnel cohorts, in the form of epidemiological studies on delayed health effects induced by the cosmic-ray generated atmospheric radiation environment, a high- LET low dose and low dose rate ionizing radiation with its typical neutron component, to which flight personnel are exposed all throughout their work activity. In the perspective of worldwide studies on radiation exposure of the civil aviation flight personnel, all the available results from previous studies on flight personnel radiation exposure have been examined in various ways (i.e. literature review, meta-analysis) to evaluate

possible significant associations between atmospheric ionizing radiation environment and health risks, and to assess directions for future investigations. The physical characteristics of the atmospheric ionizing radiation environment make the results obtained for atmospheric flight personnel relevant for space exploration.
Author
Civil Aviation; Flying Personnel; Ionizing Radiation; Risk; Extraterrestrial Radiation; Health Physics

20030063000 Royal Military Coll. of Canada, Kingston, Ontario, Canada
Assessment of High-Altitude Cosmic Radiation Exposure Using Tissue Equivalent Proportional Counters and Bubble Detectors
Tume, P.; Lewis, B. J.; Bennett, L. G. I.; Pierre, M.; Cousins, T.; Hoffarth, B. E.; Jones, T. A.; Brisson, J. R.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 273-293; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Tissue Equivalent Proportional Counters (TEPC) and neutron bubble detector measurements have been made in support of the NASA-Langley Atmospheric Ionizing Radiation (AIR) mission. The TEPC data have been processed with quality factors from both International Commission on Radiation Units (ICRU)-40 and International Commission on Radiological Protection (ICRP)-60, yielding little difference in the dose equivalent. Microdosimetric spectra from the DREO and Boeing TEPCs are consistent. The ER-2 results have also been compared to low-altitude measurements from First Air (using the same instrumentation); an increase in the low-LET component is observed at high-altitude. A calibration factor for the bubble detector has been developed for a Hess neutron spectrum at commercial aircraft altitude, which can be updated as more neutron spectral information become available. The neutron dose equivalent as measured with the bubble detectors followed the same trend as the TEPC total dose equivalent, indicating the importance of the high-LET (i.e., neutron) contribution to the radiation field.
Author
Cosmic Rays; Neutrons; Proportional Counters; Bubbles; Tissues (Biology); Radiation Detectors; Extraterrestrial Radiation

20030063004 Eril Research, Inc., San Rafael, CA, USA
Results of Passive Radiation Detector Exposures at High-Altitude
Benton, E. R.; Benton, E. V.; Frank, A. L.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 333-342; In English; See also 20030062989; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A two element passive radiation detector, consisting of thermoluminscent detectors (TLDs) and CR-39 plastic nuclear track detectors (PNTDs), was exposed aboard a NASA ER-2 high-altitude research aircraft during the June 1997 AIR Campaign. Dose rates of 7.8 and 7.2 Gy/hr were measured using Lithium Fluoride (LiF) TLD (TLD-700) on the East-West (constant latitude) and Northbound flights, respectively, while a dose rate of 1.5 Gy/hr was measured using LiF TLD for the Southbound flight. Despite extensive efforts to analyze the CR-39 PNTDs, the short duration of the exposures, e.g. approximately 12 hours for the Northbound flights, did not provide sufficient signal above background to yield a meaningful measurement. Results from two additional high-altitude exposures carried out by ERI are reviewed.
Author
High Altitude; Thermoluminescence; Radiation Detectors; Radiation Dosage

20030063007 Boeing Information, Space and Defense Systems, Seattle, WA, USA
Assessment of High Altitude Cosmic Radiation Exposures Using a Simple Electronic Neutron Dosimeter, the PDM-303
Normand, Eugene; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 311-320; In English; See also 20030062989; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Boeing Radiation Effects Laboratory (BREL) has been using the electronic neutron dosimeter PDM-303 to monitor high-energy neutrons for several years. The response of the PDM-303 is given in dose equivalent units, mSv, via electronic readout. Although this response varies with neutron energy (from approximately 0.5-3 for E greater than 1 MeV), its ease of use and ability to be calibrated, make it suitable for monitoring neutron exposures during high altitude flights. Thus, the dosimeter was used as one of the monitors in the ER-2 flight measurements program during June, l997. Because the unit is self-powered (by a coin-sized lithium battery), it was worn by the pilot in his shin pocket on all the five scientific flights, as well as the engineering checkout flight. Its readout was taken once the airplane landed, and gave the pilot an immediate sense

of the radiation dose that he received during each flight. We compare the PDM-303 readings against two other ways of characterizing the neutron dose equivalent measurements: 1) by a much more sophisticated monitor, Boeing's TEPC, and 2) the 1-10 MeV neutron fluence for each flight as given by the NASA-Langley atmospheric neutron model, AIR. In both cases there is good agreement between the dose equivalent readings of the simple PDM-303 neutron dosimeter and the TEPC measurements, as well as with the AIR model neutron fluences.
Derived from text
Cosmic Rays; Dosimeters; Exposure; High Altitude; Neutrons; Radiation Dosage

20030063008 National Radiological Protection Board, Chilton, UK
The Determination Using Passive Dosemeters of Aircraft Crew Dose
Bartlett, David T.; Hager, Luke G.; Tanner, Richard J.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 321-332; In English; See also 20030062989; Original contains black and white illustrations
Contract(s)/Grant(s): F14P-CT95-0011; No Copyright; Avail: CASI; A03, Hardcopy

The results which have been reported here are given with other results obtained by the same approach for London-Tokyo flights (Bagshaw et al. 1996) and London-New York by Concorde, and the results reviewed by EURADOS (1996). The route doses obtained using the passive survey meter have been converted to a mean dose rate over the range of cruising altitudes. The results are in broad agreement. Given the difficulties of measuring and determining dose equivalent quantities to the complex radiation field in aircraft at altitude, agreement of measured and calculated values to within 20-30\% must be considered satisfactory. For many circumstances in routine radiation protection, in the nuclear industry for example, agreement this close would be found to be most acceptable. However, meaningful comparison of, and understanding of the results shown here and elsewhere can only be made if what is being measured is well defined and where the response characteristics of the device are well known. For the results we have reported, there are various aspects which require further investigation. One is the degree of confidence in the CERN European Commission Reference Field (CERF) neutron spectrum. At the moment the results of the FLUKA calculations have been accepted without reservation. There are supporting data showing agreement of measured and calculated instrument readings, and there are measurements of the spectrum, all of which may need to be re-evaluated. The second is the validity of using the CERF neutron spectrum as a calibration spectrum. How well does it correspond to the spectrum in aircraft at cruising altitudes? How much does the spectrum in aircraft vary? The third is the variability of the measurement system. The fourth is the uncertainty in the relative magnitude of the proton component of the non-neutron doses needed to separate the proton component in order to apply the ICRP radiation weighting factor. Effort is being devoted to these matters.
Derived from text
Flight Crews; Radiation Dosage; Neutrons; Dosimeters

20030063009 NASA Langley Research Center, Hampton, VA, USA
Preliminary Analysis of the Multisphere Neutron Spectrometer
Goldhagen, P.; Kniss, T.; Wilson, J. W.; Singleterry, R. C.; Jones, I. W.; VanSteveninck, W.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 165-185; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Crews working on present-day jet aircraft are a large occupationally exposed group with a relatively high average effective dose from galactic cosmic radiation. Crews of future high-speed commercial aircraft flying at higher altitudes would be even more exposed. To help reduce the significant uncertainties in calculations of such exposures, the Atmospheric Ionizing Radiation (AIR) Project, an international collaboration of 15 laboratories, made simultaneous radiation measurements with 14 instruments on five flights of a NASA ER-2 high-altitude aircraft. The primary AIR instrument was a highly sensitive extended-energy multisphere neutron spectrometer with lead and steel shells placed within the moderators of two of its 14 detectors to enhance response at high energies. Detector responses were calculated for neutrons and charged hadrons at energies up to 100 GeV using MCNPX. Neutron spectra were unfolded from the measured count rates using the new MAXED code. We have measured the cosmic-ray neutron spectrum (thermal to greater than 10 GeV), total neutron fluence rate, and neutron effective dose and dose equivalent rates and their dependence on altitude and geomagnetic cutoff. The measured cosmic-ray neutron spectra have almost no thermal neutrons, a large 'evaporation' peak near 1 MeV and a second broad peak near 100 MeV which contributes about 69\% of the neutron effective dose. At high altitude, geomagnetic latitude has very little effect on the shape of the spectrum, but it is the dominant variable affecting neutron fluence rate, which was 8 times higher at the northernmost measurement location than it was at the southernmost. The shape of the spectrum varied only slightly with altitude from 21 km down to 12 km (56 - 201 grams per square centimeter atmospheric depth), but was significantly different

on the ground. In all cases, ambient dose equivalent was greater than effective dose for cosmic-ray neutrons. Author

Atmospheric Radiation; Ionizing Radiation; Neutron Spectrometers; Radiation Measurement

20030063010 NASA Langley Research Center, Hampton, VA, USA

Overview of Atmospheric Ionizing Radiation (AIR)

Wilson, J. W.; Maiden, D. L.; Goldhagen, P.; Tai, H.; Shinn, J. L.; Atmospheric Ionizing Radiation (AIR): Analysis, Results, and Lessons Learned From the June 1997 ER-2 Campaign; February 2003, pp. 27-105; In English; See also 20030062989; Original contains black and white illustrations; No Copyright; Avail: CASI; A05, Hardcopy

The SuperSonic Transport (SST) development program within the US was based at the Langley Research Center as was the Apollo radiation testing facility (Space Radiation Effects Laboratory) with associated radiation research groups. It was natural for the issues of the SST to be first recognized by this unique combination of research programs. With a re-examination of the technologies for commercial supersonic flight and the possible development of a High Speed Civil Transport (HSCT), the remaining issues of the SST required resolution. It was the progress of SST radiation exposure research program founded by T. Foelsche at the Langley Research Center and the identified remaining issues after that project over twenty-five years ago which became the launch point of the current atmospheric ionizing radiation (AIR) research project. Added emphasis to the need for reassessment of atmospheric radiation resulted from the major lowering of the recommended occupational exposure limits, the inclusion of aircrew as radiation workers, and the recognition of civil aircrew as a major source of occupational exposures. Furthermore, the work of Ferenc Hajnal of the Environmental Measurements Laboratory brought greater focus to the uncertainties in the neutron flux at high altitudes. A re-examination of the issues involved was committed at the Langley Research Center and by the National Council on Radiation Protection (NCRP). As a result of the NCRP review, a new flight package was assembled and flown during solar minimum at which time the galactic cosmic radiation is at a maximum (June 1997). The present workshop is the initial analysis of the new data from that flight. The present paper is an overview of the status of knowledge of atmospheric ionizing radiations. We will re-examine the exposures of the world population and examine the context of aircrew exposures with implications for the results of the present research. A condensed version of this report was given at the 1998 Annual Meeting of the NCRP with proceedings published in the journal of Health Physics. Author

Atmospheric Radiation; Ionizing Radiation; Radiation Dosage

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20030062032 NASA Marshall Space Flight Center, Huntsville, AL, USA

AFM Studies of Salt Concentration Effects on the (110) Surface Structure of Tetragonal Lysozyme Crystals

Pusey, Marc Lee; Gorti, Sridhar; Forsythe, Elizabeth; Konnert, John; [2002]; 1 pp.; In English; Biophysical Society Meeting 2003, 1-5 Mar. 2003, San Antonio, TX, USA; Copyright; Avail: Other Sources; Abstract Only

Previous high resolution AFM studies of the (110) surface of tetragonal chicken egg white lysozyme crystals had shown that only one of two possible molecular surfaces is present, those constituting the completed 43 helices. These suggested that the crystal growth process was by the solution-phase assembly of the growth units, which then attach to the surface. However, the best fit for the imaged surfaces, vs. those predicted based upon the bulk crystallographic coordinates, were obtained when the packing about the 43 helices was 'tightened up', while maintaining the underlying crystallographic unit cell spacing. This results in a widening of the gap between adjacent helices, and the top- most layer(s) may no longer be in contact. We postulated that the tightened packing about the helices is a result of the high salt concentrations in the bulk solution, used to crystallize the protein, driving hydrophobic interactions. Once the crystal surface is sufficiently buried by subsequent growth layers the ratio of salt to protein molecules decreases and the helices relax to their bulk crystallographic coordinates. The crystal surface helix structure is thus a reflection of the solution structure, and the tightness of the packing about the 43 helices would be a function of the bulk salt concentration. AFM images of the (110) surface of tetragonal lysozyme crystals grown under low

(2\%) and high (5\%) NaCl concentrations reveal differences in the packing about the 43 helices consistent with the above proposal.
Author
Concentration (Composition); Salts; Crystal Growth; Crystallography; Lysozyme

20030062819 University of West Florida, Pensacola, FL, USA
KSC History Project
Moore, Patrick K.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2003, pp. 109-118; In English; See also 20030062814; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The 2002 NASA/ASEE KSC History Project focused on a series of seven history initiatives designed to acquire, preserve, and interpret the history of Kennedy Space Center. These seven projects included the co-authoring of Voices From the Cape, historical work with NASA historian Roger Launius, the completion of a series of oral histories with key KSC personnel, a monograph on Public Affairs, the development of a Historical Concept Map (CMap) for history knowledge preservation, advice on KSC history database and web interface capabilities, the development of a KSC oral history program and guidelines of training and collection, and the development of collaborative relationships between Kennedy Space Center, the University of West Florida, and the University of Central Florida.
Author
NASA Space Programs; Histories; Education

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